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Divisions 3 through 9

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**U.S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
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SAVANNAH, GEORGIA 31401-3640**

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SECTION 03100A

STRUCTURAL CONCRETE FORMWORK
05/98

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 347R (1994) Guide to Formwork for Concrete

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 578 (1995) Rigid, Cellular Polystyrene Thermal Insulation

U.S. DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1996) Voluntary Product Standard - Construction and Industrial Plywood

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

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SD-02 Shop Drawings

Formwork; G, ~~REA/E~~

Drawings showing details of formwork, including dimensions of fiber voids, joints, supports, studding and shoring, and sequence of form and shoring removal.

SD-03 Product Data

Design; G, A/E

Design analysis and calculations for form design and methodology used in the design.

Form Materials

Manufacturer's data including literature describing form materials, accessories, and form releasing agents.

Form Releasing Agents

Manufacturer's recommendation on method and rate of application of form releasing agents.

1.3 DESIGN

Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the class of finish specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

1.4 STORAGE AND HANDLING

Fiber voids shall be stored above ground level in a dry location. Fiber voids shall be kept dry until installed and overlaid with concrete.

PART 2 PRODUCTS

2.1 FORM MATERIALS

2.1.1 Forms For Class A and Class B Finish

Forms for Class A and Class B finished surfaces shall be plywood panels conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood concrete form panels. Forms for round columns shall be the prefabricated seamless type.

2.1.2 Forms For Class C Finish

Forms for Class C finished surfaces shall be shiplap lumber; plywood conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II; tempered concrete form hardboard conforming to AHA A135.4; other approved concrete form material; or steel, except that steel lining on wood sheathing shall not be used. Forms for round columns may have one vertical seam.

2.1.3 Forms For Class D Finish

Forms for Class D finished surfaces, except where concrete is placed against earth, shall be wood or steel or other approved concrete form material.

2.1.4 Form Ties

Form ties shall be factory-fabricated metal ties, shall be of the removable or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spall concrete upon removal. Solid backing shall be provided for each tie. Except where removable tie

rods are used, ties shall not leave holes in the concrete surface less than 6 mm nor more than 25 mm deep and not more than 25 mm in diameter. Removable tie rods shall be not more than 38 mm in diameter.

2.1.5 Form Releasing Agents

Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Formwork

Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE and conforming to construction tolerance given in TABLE 1. Where concrete surfaces are to have a Class A or Class B finish, joints in form panels shall be arranged as approved. Where forms for continuous surfaces are placed in successive units, the forms shall fit over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concreting and of all other foreign material before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

3.2 CHAMFERING

Except as otherwise shown, external corners that will be exposed shall be chamfered, beveled, or rounded by moldings placed in the forms.

3.3 COATING

Forms for Class A and Class B finished surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Forms for Class C and D finished surfaces may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures, coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.4 REMOVAL OF FORMS

Forms shall be removed preventing injury to the concrete and ensuring the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement. Supporting forms and shores shall not be removed from beams, floors and walls until the structural units are strong enough to carry their own weight and any other construction or natural loads.

Supporting forms or shores shall not be removed before the concrete strength has reached 70 percent of design strength, as determined by field cured cylinders or other approved methods. This strength shall be demonstrated by job-cured test specimens, and by a structural analysis considering the proposed loads in relation to these test strengths and the strength of forming and shoring system. The job-cured test specimens for form removal purposes shall be provided in numbers as directed and shall be in addition to those required for concrete quality control. The specimens shall be removed from molds at the age of 24 hours and shall receive, insofar as possible, the same curing and protection as the structures they represent.

TABLE 1

TOLERANCES FOR FORMED SURFACES

1. Variations from the plumb:	In any 3 m of length ----- 6 mm
a. In the lines and surfaces of columns, piers, walls and in arises	Maximum for entire length -- 25 mm
b. For exposed corner columns, control-joint grooves, and other conspicuous lines	In any 6 m of length ----- 6 mm Maximum for entire length 13 mm
2. Variation from the level or from the grades indicated on the drawings:	In any 3 m of length ----- 6 mm In any bay or in any 6 m of length ----- 10 mm
a. In slab soffits, ceilings beam soffits, and in arises, measured before removal of supporting shores	Maximum for entire length - 20 mm
b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines	In any bay or in any 6 m of length ----- 6 mm Maximum for entire length - 13 mm
3. Variation of the linear building lines from established position in plan	In any 6 m ----- 13 mm Maximum ----- 25 mm
4. Variation of distance between walls, columns, partitions	6 mm per 3 m of distance, but not more than 13 mm in any one bay, and not more than 25 mm total variation
5. Variation in the sizes and locations of sleeves, floor openings,	Minus ----- 6 mm Plus ----- 13 mm

TABLE 1

TOLERANCES FOR FORMED SURFACES

and wall opening

- | | | |
|----|--|--|
| 6. | Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls | Minus ----- 6 mm
Plus ----- 13 mm |
| 7. | Footings: | |
| a. | Variation of dimensions in plan | Minus ----- 13 mm
Plus ----- 50 mm
when formed or plus 75 mm when placed against unformed excavation |
| b. | Misplacement of eccentricity | 2 percent of the footing width in the direction of misplacement but not more than ----- 50 mm |
| c. | Reduction in thickness | Minus ----- 5 percent
of specified thickness |
| 8. | Variation in steps: | Riser ----- 3 mm |
| a. | In a flight of stairs | Tread ----- 6 mm |
| b. | In consecutive steps | Riser ----- 2 mm
Tread ----- 3 mm |

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SECTION 03150A

EXPANSION JOINTS AND CONTRACTION JOINTS, AND WATERSTOPS

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SECTION 03150A

EXPANSION JOINTS AND CONTRACTION JOINTS, AND WATERSTOPS

05/98

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 920	(1998) Elastomeric Joint Sealants
ASTM D 471	(1998el) Rubber Property - Effect of Liquids
ASTM D 1190	(1997) Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996el) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 5249	(1995) Backer Material for Use With Cold and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Waterstops; as indicated

Shop drawings and fabrication drawings provided by the manufacturer or prepared by the Contractor.

SD-03 Product Data

Preformed Expansion Joint Filler
Sealant

Manufacturer's literature, including safety data sheets, for preformed fillers and the lubricants used in their installation; field-molded sealants and primers (when required by sealant manufacturer); and waterstops.

SD-07 Certificates

Preformed Expansion Joint Filler
Sealant
Waterstops; as indicated

Certificates of compliance stating that the joint filler and sealant materials conform to the requirements specified.

1.3 DELIVERY AND STORAGE

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

PART 2 PRODUCTS

2.1 CONTRACTION JOINT STRIPS

Contraction joint strips shall be 3 mm (1/8 inch) thick tempered hardboard conforming to AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

2.2 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D 1751 or ASTM D 1752. Unless otherwise indicated, filler material shall be 10 mm (3/8 inch) thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249.

2.3 SEALANT

Joint sealant shall conform to the following:

2.3.1 Field-Molded Type

ASTM C 920, Type M for horizontal joints or Type NS for vertical joints, Class 25, and Use NT. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber.

2.4 WATERSTOPS

Intersection and change of direction waterstops shall be shop fabricated.

2.4.1 [Enter Appropriate Subpart Title Here] 2.4.2 Non-Metallic Materials`

Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471.

PART 3 EXECUTION

3.1 JOINTS

Joints shall be installed at locations indicated and as authorized.

3.1.1 Contraction Joints

Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Joints shall be approximately 3 mm wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than 25 mm .

3.1.1.1 Joint Strips

Strips shall be of the required dimensions and as long as practicable. After the first floating, the concrete shall be grooved with a tool at the joint locations. The strips shall be inserted in the groove and depressed until the top edge of the vertical surface is flush with the surface of the slab. The slab shall be floated and finished as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, the top portion of the strip shall be sawed out after the curing period to form a recess for sealer. The removable section of PVC or HIPS strips shall be discarded and the insert left in place. True alignment of the strips shall be maintained during insertion.

3.1.1.2 Sawed Joints

Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the

required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed.

3.1.2 Expansion Joints

Preformed expansion joint filler shall be used in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. The filler shall extend the full slab depth, unless otherwise indicated. The edges of the joint shall be neatly finished with an edging tool of 3 mm (1/8 inch) radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. The wood strip shall be removed after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. The groove shall be thoroughly cleaned of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust which shall be blown out of the groove with oil-free compressed air.

3.1.3 Joint Sealant

Sawed contraction joints and expansion joints in slabs shall be filled with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant.

3.2 WATERSTOPS, INSTALLATION AND SPLICES

Waterstops shall be installed at the locations shown to form a continuous water-tight diaphragm. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. Exposed waterstops shall be protected during application of form release agents to avoid being coated. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Splices shall be made by certified trained personnel using approved equipment and procedures.

3.2.1 [Enter Appropriate Subpart Title Here] 3.2.1.1 Polyvinyl Chloride Waterstop

Splices shall be made by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. The correct temperature shall be used to sufficiently melt without charring the plastic. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

3.3 CONSTRUCTION JOINTS

Construction joints are specified in Section 03300 CAST-IN-PLACE STRUCTURAL

CONCRETE except that construction joints coinciding with expansion and contraction joints shall be treated as expansion or contraction joints as applicable.

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SECTION 03151A

EXPANSION, CONTRACTION AND CONSTRUCTION JOINTS IN CONCRETE FOR CIVIL WORKS

09/01

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SECTION 03151A

EXPANSION, CONTRACTION AND CONSTRUCTION JOINTS IN CONCRETE FOR CIVIL WORKS
09/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 109/A 109M	(2000) Steel, Strip, Carbon, Cold-Rolled
ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 570/A 570M	(1998) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
ASTM B 152	(1997a) Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B 152M	(1997a) Copper Sheet, Strip, Plate, and Rolled Bar (Metric)
ASTM C 920	(1998) Elastomeric Joint Sealants
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996el) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 2628	(1991; R 1998) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

ASME INTERNATIONAL (ASME)

ASME BPVC SEC IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office

that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-04 Samples

Field Molded Sealants and Primer; G, ~~REA/E~~

Four liters of field-molded sealant and 1 L of primer (when primer is recommended by the sealant manufacturer) shall be provided for testing.

SD-06 Test Reports

Premolded Expansion Joint Filler Strips; G, ~~REA/E~~

Certified manufacturer's test reports shall be provided for premolded expansion joint filler strips to verify compliance with applicable specification.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Premolded Expansion Joint Filler Strips

Premolded expansion joint filler strips shall conform to ASTM D 1751 or ASTM D 1752, Type I, or resin impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

2.1.2 Joint Seals and Sealants

2.1.2.1 Field Molded Sealants and Primer

Field molded sealants and primer shall conform to ASTM C 920, Type M, Grade NS, Class 25, use NT for vertical joints and Type M, Grade P, Class 25, use T for horizontal joints. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, nonshrink, nonreactive with sealant, and nonabsorptive material type such as extruded butyl or polychloroprene foam rubber.

2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

2.2.1 Materials Tests

2.2.1.1 Field-Molded Sealants

Samples of sealant and primer, when use of primer is recommended by the manufacturer, as required in paragraph FIELD MOLDED SEALANTS AND PRIMER, shall be tested by and at the expense of the Government for compliance with paragraph FIELD MOLDED SEALANTS AND PRIMER. If the sample fails to meet specification requirements, new samples shall be provided and the cost of retesting will be deducted from payments due the Contractor at a rate of \$100.00 per sample.

PART 3 EXECUTION

3.1 INSTALLATION

Joint locations and details, including materials and methods of installation of joint fillers shall be as specified, as shown, and as directed. In no case shall any fixed metal be continuous through an expansion or contraction joint.

3.1.1 Expansion Joints

Premolded filler strips shall have oiled wood strips secured to the top thereof and shall be accurately positioned and secured against displacement to clean, smooth concrete surfaces. The wood strips shall be slightly tapered, dressed and of the size required to install filler strips at the desired level below the finished concrete surface and to form the groove for the joint sealant or seals to the size shown. Material used to secure premolded fillers and wood strips to concrete shall not harm the concrete and shall be compatible with the joint sealant or seals. The wood strips shall not be removed until after the concrete curing period. The groove shall be thoroughly cleaned of all laitance, curing compound, foreign materials, protrusions of hardened concrete and any dust which shall be blown out of the groove with oil-free compressed air.

3.1.1.1 Joints With Field-Molded Sealant

Joints shall not be sealed when the sealant, air or concrete temperature is less than 4 degrees C. Immediately prior to installation of field molded sealants, the joint shall be cleaned of all debris and further cleaned using water, chemical solvents or other means as recommended by the sealant manufacturer. The joints shall be dry prior to filling with sealant. Bond breaker and back-up material shall be installed where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendations.

3.1.2 Contraction Joints

Joints requiring a bond breaker shall be coated with curing compound or with bituminous paint.

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SECTION 03200A

CONCRETE REINFORCEMENT

09/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 318/318R	(1995) Building Code Requirements for Structural Concrete and Commentary
ACI 318M	(1995) Building Code Requirements for Structural Concrete and Commentary (Metric)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1999) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 82	(1997a) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 184/A 184M	(1996) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	(1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 496	(1997) Steel Wire, Deformed, for Concrete Reinforcement
ASTM A 497	(1997) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 615/A 615M	(1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 675/A 675M	(1990a; R 1995e1) Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM A 706/A 706M	(1998) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 767/A 767M	(1997) Zinc-Coated (Galvanized) Steel Bars in Concrete Reinforcement

ASTM A 775/A 775M (1997e1) Epoxy-Coated Reinforcement Steel Bars

ASTM A 884/A 884M (1996ae1) Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement

ASTM C 1116 (1995) Fiber-Reinforced Concrete and Shotcrete

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4 (1998) Structural Welding Code - Reinforcing Steel

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI MSP-1 (1996) Manual of Standard Practice

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-02 Shop Drawings

Reinforcement; G, REA/E

Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

SD-03 Product Data

Welding

A list of qualified welders names.

SD-07 Certificates

Reinforcing Steel; G, REA/E

Certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

1.3 WELDING

Welders shall be qualified in accordance with AWS D1.4. Qualification test shall be performed at the worksite and the Contractor shall notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4.

1.4 DELIVERY AND STORAGE

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 DOWELS

Dowels shall conform to ASTM A 675/A 675M, Grade 80. Steel pipe conforming to ASTM A 53, Schedule 80, may be used as dowels provided the ends are closed with metal or plastic inserts or with mortar.

2.2 FABRICATED BAR MATS

Fabricated bar mats shall conform to ASTM A 184/A 184M.

2.3 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M or ASTM A 706/A 706M, grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 82.

2.4 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185.

2.5 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.6 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 100 by 100 mm when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 13 mm of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

PART 3 EXECUTION

3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318M. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other

deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318M at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318M. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318M and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Welding shall conform to AWS D1.4. Welded butt splices shall be full penetration butt welds. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 150 mm. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 50 mm. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 1.2 m. Fabric shall be positioned by the use of supports.

3.3 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

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SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE

05/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 117/117R	(1990; Errata) Standard Tolerances for Concrete Construction and Materials
ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 211.2	(1998) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 213R	(1987) Guide for Structural Lightweight Aggregate Concrete
ACI 214.3R	(1988; R 1997) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 301	(1999) Standard Specifications for Structural Concrete
ACI 303R	(1991) Guide to Cast-In-Place Architectural Concrete Practice
ACI 305R	(1999) Hot Weather Concreting
ACI 318/318R	(1999) Building Code Requirements for Structural Concrete and Commentary

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 182	(1991; R 1996) Burlap Cloth Made From Jute or Kenaf
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31/C 31M	(2000) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1999ael) Concrete Aggregates
ASTM C 39/C 39M	(1999) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42/C 42M	(1999) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 78	(1994) Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
ASTM C 94/C 94M	(2000) Ready-Mixed Concrete
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 143/C 143M	(2000) Slump of Hydraulic Cement Concrete
ASTM C 150	(1999a) Portland Cement
ASTM C 171	(1997a) Sheet Materials for Curing Concrete
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 173	(1994ael) Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 192/C 192M	(2000) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1997el) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2000) Air-Entraining Admixtures for Concrete
ASTM C 309	(1998a) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 330	(2000) Lightweight Aggregates for Structural Concrete
ASTM C 494/C 494M	(1999a) Chemical Admixtures for Concrete

ASTM C 496	(1996) Splitting Tensile Strength of Cylindrical Concrete Specimens
ASTM C 552	(2000) Cellular Glass Thermal Insulation
ASTM C 567	(2000) Unit Weight of Structural Lightweight Concrete
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 595	(2000a) Blended Hydraulic Cements
ASTM C 595M	(1997) Blended Hydraulic Cements (Metric)
ASTM C 618	(2000) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 685	(2000) Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 937	(1997) Grout Fluidifier for Preplaced-Aggregate Concrete
ASTM C 940	(1998a) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
ASTM C 989	(1999) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1017/C 1017M	(1998) Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1059	(1999) Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C 1064/C 1064M	(1999) Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	(1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 1107	(1999) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

ASTM C 1116	(2000) Fiber-Reinforced Concrete and Shotcrete
ASTM C 1240	(2000) Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar and Grout
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996el) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM E 96	(2000) Water Vapor Transmission of Materials
ASTM E 1155	(1996) Determining Floor Flatness and Levelness Using the F-Number System
ASTM E 1155M	(1996) Determining Floor Flatness and Levelness Using the F-Number System (Metric)

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 94	(1995) Surface Retarders
COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete
COE CRD-C 540	(1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(1997) NIST Handbook 44: Specifications, Tolerances, and Other Technical
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Requirements for Weighing and Measuring
Devices

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(1996) Concrete Plant Standards
NRMCA TMMB 100	(1994) Truck Mixer Agitator and Front Discharge Concrete Carrier Standards
NRMCA QC 3	(1984) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities

1.2 LUMP SUM CONTRACT

Under this type of contract concrete items will be paid for by lump sum and will not be measured. The work covered by these items consists of furnishing all concrete materials, reinforcement, miscellaneous embedded materials, and equipment, and performing all labor for the forming, manufacture, transporting, placing, finishing, curing, and protection of concrete in these structures.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Mixture Proportions; G, RE

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

SD-04 Samples

Surface Retarder

Sample of surface retarder material with manufacturer's instructions for application in conjunction with air-water cutting.

SD-06 Test Reports

Testing and Inspection for Contractor Quality Control; G, RE

Certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

SD-07 Certificates

Qualifications

Written documentation for Contractor Quality Control personnel.

1.4 QUALIFICATIONS

Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades or shall have written evidence of having completed similar qualification programs:

Concrete Field Testing Technician, Grade I
Concrete Laboratory Testing Technician, Grade I or II
Concrete Construction Inspector, Level II

Concrete Transportation Construction Inspector or
Reinforced Concrete Special Inspector, Jointly certified by American Concrete Institute (ACI), Building Official and Code Administrators International (BOCA), International Conference of Building Officials (ICBO), and Southern Building Code Congress International (SBCCI).

The foreman or lead journeyman of the flatwork finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher or equal, with written documentation.

1.5 GENERAL REQUIREMENTS

1.5.1 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117/117R. Level and grade tolerance measurements of slabs shall be made as soon as possible after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

1.5.1.1 Floors

For the purpose of this Section the following terminology correlation between ACI 117/117R and this Section shall apply:

Floor Profile Quality Classification From ACI 117/117R -----	This Section -----
Conventional Bullfloated	Same
Conventional Straightedged	Same
Flat	Float Finish or Trowel Finish

Levelness tolerance shall not apply where design requires floors to be sloped to drains or sloped for other reasons.

1.5.1.2 Floors by the F-Number System

The flatness and levelness of floors shall be carefully controlled and the tolerances shall be measured by the F-Number system of Paragraph 4.5.6 and 4.5.6.1 of ACI 117/117R. The Contractor shall furnish an approved floor profilograph or other equipment capable of measuring the floor flatness (FF) number and the floor levelness (FL) number in accordance with ASTM E 1155M . The Contractor shall perform the tolerance measurements within 72 hours after floor slab construction while being observed by the Contracting Officer. The tolerances of surfaces beyond the limits of ASTM E 1155M (the areas within 600 mm of embedments and construction joints) shall be acceptable to the Contracting Officer. Tolerances of the following areas shall meet the requirements for the listed surfaces as specified in paragraphs 4.5.6 and 4.5.6.1 of ACI 117/117R.

Bullfloated-	Areas as indicated.
Straightedged-	Areas as indicated.
Float Finish-	Areas as indicated.
Trowel Finish-	Areas specified overall values of flatness, F(F) 30; and levelness, F(L) 20; with minimum local values of flatness

1.5.2 Strength Requirements and w/c Ratio

1.5.2.1 Strength Requirements

Specified compressive strength (f'c) shall be as follows:

COMPRESSIVE STRENGTH	STRUCTURE OR PORTION OF STRUCTURE
27.5 MPa at 28 days, as indicated	
20 MPa at 28 days, as indicated	

- a. Evaluation of Concrete Compressive Strength. Compressive strength specimens (152 by 305 mm cylinders) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39/C 39M. The strength of

the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'_c and no individual test result falls below the specified strength f'_c by more than 3.5 MPa. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.

- b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 3.5 MPa or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42/C 42M. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.
- c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318/318R. Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and must be approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

1.5.2.2 Water-Cement Ratio

Maximum water-cement ratio (w/c) for normal weight concrete shall be as follows:

WATER-CEMENT RATIO, BY WEIGHT	STRUCTURE OR PORTION OF STRUCTURE
0.45	For concrete exposed to

WATER-CEMENT RATIO, BY WEIGHT STRUCTURE OR PORTION OF STRUCTURE
 deicers are subject to freezing and thawing while moist (exterior slab on
 grade)
 0.50 For all concrete unless
 noted otherwise.

These w/c's may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1.

In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations of ACI 211.1 for the term P which is used to denote the weight of pozzolan.

1.5.3 Air Entrainment

Except as otherwise specified for lightweight concrete, all normal weight concrete shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 19 mm or smaller it shall be between 4.5 and 7.5 percent. Concrete with specified strength over 35 MPa may have 1.0 percent less air than specified above. Specified air content shall be attained at point of placement into the forms. Air content for normal weight concrete shall be determined in accordance with ASTM C 231.

1.5.4 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C 143/C 143M.

Structural Element	Slump	
	Minimum	Maximum
Walls and beams	50 mm	100 mm
Foundation walls, substructure walls, footings, slabs	25 mm	75 mm
Any structural concrete approved for placement by pumping:		
At pump	50 mm	150 mm
At discharge of line	25 mm	100 mm

When use of a plasticizing admixture conforming to ASTM C 1017/C 1017M or when a Type F or G high range water reducing admixture conforming to ASTM C 494/C 494M is permitted to increase the slump of concrete, concrete shall have a slump of 50 to 100 mm before the admixture is added and a maximum slump of 200 mm at the point of delivery after the admixture is added.

1.5.5 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 32 degrees C.

When the ambient temperature during placing is 5 degrees C or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 12 and 25 degrees C.

1.5.6 Size of Coarse Aggregate

The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

1.6 MIXTURE PROPORTIONS

Concrete shall be composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

1.6.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Except as specified for flexural strength concrete, mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39/C 39M. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratios required in subparagraph Water-Cement Ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations in ACI 211.1 for the term P, which is used to denote the weight of pozzolan. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by weight of the total cementitious material, and the maximum shall be 35 percent. Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use.

No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these

specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192/C 192M. They shall be tested at 7 and 28 days in accordance with ASTM C 39/C 39M. From these test results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

1.6.2 Average Compressive Strength Required for Mixtures

The mixture proportions selected during mixture design studies shall produce a required average compressive strength (f'_{cr}) exceeding the specified compressive strength (f'_c) by the amount indicated below. This required average compressive strength, f'_{cr} , will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below f'_{cr} during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day f'_{cr} , the mixture shall be adjusted, as approved, to bring the daily average back up to f'_{cr} . During production, the required f'_{cr} shall be adjusted, as appropriate, based on the standard deviation being attained on the job.

1.6.2.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths (f'_c) within 7 MPa of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength f'_{cr} used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

$$f'_{cr} = f'_c + 1.34S \text{ where units are in MPa}$$

$$f'_{cr} = f'_c + 2.33S - 3.45 \text{ where units are in MPa}$$

Where S = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

1.6.2.2 Computations without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength f'_{cr} shall be determined as follows:

- a. If the specified compressive strength f'_c is less than 20 MPa,

$$f'_{cr} = f'_c + 6.9 \text{ MPa}$$

- b. If the specified compressive strength f'_c is 20 to 35 MPa,

$$f'_{cr} = f'_c + 8.3 \text{ MPa}$$

- c. If the specified compressive strength f'_c is over 35 MPa,

$$f'_{cr} = f'_c + 9.7 \text{ MPa}$$

1.7 STORAGE OF MATERIALS

Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

1.8 GOVERNMENT ASSURANCE INSPECTION AND TESTING

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered

appropriate and will monitor operations of the Contractor's CQC staff. Government inspection or testing will not relieve the Contractor of any of his CQC responsibilities.

1.8.1 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

1.8.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications, as considered necessary.

1.8.3 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such tests are considered necessary.

1.8.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement, and shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

2.1.1 Portland Cement

ASTM C 150, Type I or Type II.

2.2 AGGREGATES

Aggregates shall conform to the following.

2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of

ASTM C 33.

2.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S, size designation 25.4 mm.

2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

2.3.1 Air-Entraining Admixture

ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.

2.3.2 Accelerating Admixture

ASTM C 494/C 494M, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

2.3.3 Water-Reducing or Retarding Admixture

ASTM C 494/C 494M, Type A, B, or D, except that the 6-month and 1-year compressive and flexural strength tests are waived.

2.3.4 High-Range Water Reducer

ASTM C 494/C 494M, Type F or G, except that the 6-month and 1-year strength requirements are waived. The admixture shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.3.5 Surface Retarder

COE CRD-C 94.

2.3.6 Expanding Admixture

Aluminum powder type expanding admixture conforming to ASTM C 937.

2.4 CURING MATERIALS

2.4.1 Membrane-Forming Compound

Membrane-Forming curing compound shall conform to ASTM C 309, Type 1-D or 2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint,

roofing, waterproofing, or flooring specified. Nonpigmented compound shall contain a fugitive dye, and shall have the reflective requirements in ASTM C 309 waived.

2.4.2 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to AASHTO M 182.

2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

2.6 NONSHRINK GROUT

Nonshrink grout shall conform to ASTM C 1107, Grades A, B, and C, and shall be a commercial formulation suitable for the proposed application.

2.7 NONSLIP SURFACING MATERIAL

Nonslip surfacing material shall consist of 55 percent, minimum, aluminum oxide or silicon-dioxide abrasive ceramically bonded together to form a homogeneous material sufficiently porous to provide a good bond with portland cement paste; or factory-graded emery aggregate consisting of not less than 45 percent aluminum oxide and 25 percent ferric oxide. The aggregate shall be well graded from particles retained on the 0.6 mm sieve to particles passing the 2.36 mm sieve.

2.8 LATEX BONDING AGENT

Latex agents for bonding fresh to hardened concrete shall conform to ASTM C 1059.

2.9 EPOXY RESIN

Epoxy resins for use in repairs shall conform to ASTM C 881, Type V, Grade 2. Class as appropriate to the existing ambient and surface temperatures.

2.10 EMBEDDED ITEMS

Embedded items shall be of the size and type indicated or as needed for the application. Dovetail slots shall be galvanized steel. Hangers for suspended ceilings shall be as specified in Section 09510 ACOUSTICAL CEILINGS. Inserts for shelf angles and bolt hangers shall be of malleable iron or cast or wrought steel.

2.11 FLOOR HARDENER

Floor hardener shall be a colorless aqueous solution containing zinc silicofluoride, magnesium silicofluoride, or sodium silicofluoride. These silicofluorides can be used individually or in combination. Proprietary hardeners may be used if approved in writing by the Contracting Officer.

2.12 PERIMETER INSULATION

Perimeter insulation shall be polystyrene conforming to ASTM C 578, Type II; polyurethane conforming to ASTM C 591, Type II; or cellular glass conforming to ASTM C 552, Type I or IV. Insulation shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.13 VAPOR BARRIER

Vapor barrier shall be polyethylene sheeting with a minimum thickness of 0.15 mm or other equivalent material having a vapor permeance rating not exceeding 30 nanograms per Pascal per second per square meter as determined in accordance with ASTM E 96 where indicated on the slab plans, provide reinforced vapor retarder to comply with Section 07191 VAPOR RETARDERS.

2.14 JOINT MATERIALS

2.14.1 Joint Fillers, Sealers, and Waterstops

Expansion joint fillers shall be preformed materials conforming to ASTM D 1751 and ASTM D 1752. Materials for waterstops shall be in accordance with Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS. Materials for and sealing of joints shall conform to the requirements of Section 07900 JOINT SEALING, 02760 FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS and 02762 COMPRESSION JOINT SEALS FOR CONCRETE PAVEMENTS.

2.14.2 Contraction Joints in Slabs

Sawable type contraction joint inserts shall conform to COE CRD-C 540. Nonsawable joint inserts shall have sufficient stiffness to permit placement in plastic concrete without undue deviation from a straight line and shall conform to the physical requirements of COE CRD-C 540, with the exception of Section 3.4 "Resistance to Sawing". Plastic inserts shall be polyvinyl chloride conforming to the materials requirements of COE CRD-C 572.

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

Before commencing concrete placement, the following shall be performed. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with Section 03100 STRUCTURAL CONCRETE FORMWORK. Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with Section 03200 CONCRETE REINFORCEMENT. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading,

fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.1.1 Foundations

3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

3.1.1.2 Preparation of Rock

Rock surfaces upon which concrete is to be placed shall be free from oil, standing or running water, ice, mud, drummy rock, coating, debris, and loose, semidetached or unsound fragments. Joints in rock shall be cleaned to a satisfactory depth, as determined by the Contracting Officer, and to firm rock on the sides. Immediately before the concrete is placed, rock surfaces shall be cleaned thoroughly by the use of air-water jets or sandblasting as specified below for Previously Placed Concrete. Rock surfaces shall be kept continuously moist for at least 24 hours immediately prior to placing concrete thereon. All horizontal and approximately horizontal surfaces shall be covered, immediately before the concrete is placed, with a layer of mortar proportioned similar to that in the concrete mixture. Concrete shall be placed before the mortar stiffens.

3.1.1.3 Excavated Surfaces in Lieu of Forms

Concrete for footings may be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of Section 02315 EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS. The concrete shall be placed without becoming contaminated by loose material, and the outline of the concrete shall be within the specified tolerances.

3.1.2 Previously Placed Concrete

Concrete surfaces to which additional concrete is to be bonded shall be prepared for receiving the next horizontal lift by cleaning the construction joint surface with either air-water cutting, sandblasting, high-pressure water jet, or other approved method. Concrete at the side of vertical construction joints shall be prepared as approved by the Contracting Officer. Air-water cutting shall not be used on formed surfaces or surfaces congested with reinforcing steel. Regardless of the method used, the resulting surfaces shall be free from all laitance and inferior concrete so that clean surfaces of well bonded coarse aggregate are exposed and make up at least 10-percent of the surface area, distributed uniformly throughout the surface. The edges of the coarse aggregate shall not be undercut. The surface of horizontal construction joints shall be kept continuously wet for the first 12 hours during the 24-hour period prior to placing fresh concrete. The surface shall be washed completely clean as the last operation prior to placing the next

lift. For heavy duty floors and two-course floors a thin coat of neat cement grout of about the consistency of thick cream shall be thoroughly scrubbed into the existing surface immediately ahead of the topping placing. The grout shall be a 1:1 mixture of portland cement and sand passing the 2.36 mm sieve. The topping concrete shall be deposited before the grout coat has had time to stiffen.

3.1.2.1 Air-Water Cutting

Air-water cutting of a fresh concrete surface shall be performed at the proper time and only on horizontal construction joints. The air pressure used in the jet shall be 700 kPa plus or minus, 70 kPa, and the water pressure shall be just sufficient to bring the water into effective influence of the air pressure. When approved by the Contracting Officer, a surface retarder complying with the requirements of COE CRD-C 94 may be applied to the surface of the lift in order to prolong the period of time during which air-water cutting is effective. After cutting, the surface shall be washed and rinsed as long as there is any trace of cloudiness of the wash water. Where necessary to remove accumulated laitance, coatings, stains, debris, and other foreign material, high-pressure waterjet or sandblasting shall be used as the last operation before placing the next lift.

3.1.2.2 High-Pressure Water Jet

A stream of water under a pressure of not less than 20 MPa shall be used for cutting and cleaning. Its use shall be delayed until the concrete is sufficiently hard so that only the surface skin or mortar is removed and there is no undercutting of coarse-aggregate particles. If the waterjet is incapable of a satisfactory cleaning, the surface shall be cleaned by sandblasting.

3.1.2.3 Wet Sandblasting

Wet sandblasting shall be used after the concrete has reached sufficient strength to prevent undercutting of the coarse aggregate particles. After wet sandblasting, the surface of the concrete shall then be washed thoroughly to remove all loose materials.

3.1.2.4 Waste Disposal

The method used in disposing of waste water employed in cutting, washing, and rinsing of concrete surfaces shall be such that the waste water does not stain, discolor, or affect exposed surfaces of the structures, or damage the environment of the project area. The method of disposal shall be subject to approval.

3.1.3 Vapor Barrier

Vapor barrier shall be provided beneath the interior on-grade concrete floor slabs. The greatest widths and lengths practicable shall be used to eliminate joints wherever possible. Joints shall be lapped a minimum of 300 mm. Torn, punctured, or damaged vapor barrier material shall be removed and new vapor barrier shall be provided prior to placing concrete.

For minor repairs, patches may be made using laps of at least 300 mm. Lapped joints shall be sealed and edges patched with pressure-sensitive adhesive or tape not less than 50 mm wide and compatible with the membrane. Vapor barrier shall be placed directly on underlying subgrade, base course, or capillary water barrier, unless it consists of crushed material or large granular material which could puncture the vapor barrier.

In this case, the surface shall be choked with a light layer of sand, as approved, before placing the vapor barrier. A 50 mm layer of compacted, clean concrete sand (fine aggregate) shall be placed on top of the vapor barrier before placing concrete. Concrete placement shall be controlled so as to prevent damage to the vapor barrier, or any covering sand.

3.1.4 Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Welding shall not be performed on embedded metals within 300 mm of the surface of the concrete.

Tack welding shall not be performed on or to embedded items.

3.2 CONCRETE PRODUCTION

3.2.1 Batching, Mixing, and Transporting Concrete

Concrete shall be furnished from a ready-mixed concrete plant. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94/C 94M, except as otherwise specified. Truck mixers, agitators, and nonagitator transporting units shall comply with NRMCA TMMB 100. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete.

3.3 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in truck mixers, agitators, nonagitator transporting equipment conforming to NRMCA TMMB 100 or by approved pumping equipment. Nonagitator equipment, other than pumps, shall not be used for transporting lightweight aggregate concrete.

3.4 PLACING CONCRETE

Mixed concrete shall be discharged within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 30 degrees C, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and

walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

3.4.1 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 1.5 meters except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 300 mm thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Concrete for beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as concrete for adjoining slabs.

3.4.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 100 mm thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.6 mm, and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 150 mm into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 100 mm and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segregation or flotation of coarse aggregate shall be prevented.

Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Grate tampers ("jitterbugs") shall not be used.

3.4.3 Cold Weather Requirements

Special protection measures, approved by the Contracting Officer, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 5 degrees C. The temperature of the concrete when placed shall be not less than 10 degrees C nor more than 25 degrees C. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C 494/C 494M, Type C or E may be used, provided it contains no calcium chloride. Calcium chloride shall not be used.

3.4.4 Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 30 degrees C, the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064/C 1064M. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 49 degrees C. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature Degrees
Greater than 60	33 C
40-60	30 C
Less than 40	27 C

3.4.5 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, the Contractor shall be alert to the tendency for plastic shrinkage cracks to develop and shall institute measures to prevent this. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition the concrete placement shall

be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

3.5 JOINTS

Joints shall be located and constructed as indicated or approved. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. In general, such joints shall be located near the middle of the spans of supported slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs, unless otherwise approved. Joints shall be perpendicular to the main reinforcement. All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement shall be 50 mm clear from each joint. Except where otherwise indicated, construction joints between interior slabs on grade and vertical surfaces shall consist of 1.5 kg per square meter asphalt-saturated felt, extending for the full depth of the slab. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints. Joints to be sealed shall be cleaned and sealed as indicated and in accordance with Section 07900 JOINT SEALING.

3.5.1 Construction Joints

For concrete other than slabs on grade, construction joints shall be located so that the unit of operation does not exceed as indicated. Concrete shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the Contracting Officer. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints in walls or columns are required, a strip of 25 mm square-edge lumber, bevelled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 25 mm above

the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Previously Placed Concrete.

3.5.2 Contraction Joints in Slabs on Grade

Contraction joints shall be located and detailed as shown on the drawings. Contraction Joints shall be produced by forming a weakened plane in the concrete slab by use of rigid inserts impressed in the concrete during placing operations or sawing a continuous slot with a concrete saw. Regardless of method used to produce the weakened plane, it shall be 1/4 the depth of the slab thickness and between 3 and 5 mm wide. For saw-cut joints, cutting shall be timed properly with the set of the concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent ravelling of the edges of the saw cut. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking. Reservoir for joint sealant shall be formed as previously specified.

3.5.3 Expansion Joints

Installation of expansion joints and sealing of these joints shall conform to the requirements of Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS and Section 07900 JOINT SEALING.

3.5.4 Waterstops

Waterstops shall be installed in conformance with the locations and details shown on the drawings using materials and procedures specified in Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

3.5.5 Dowels and Tie Bars

Dowels and tie bars shall be installed at the locations shown on the drawings and to the details shown, using materials and procedures specified in Section 03200 CONCRETE REINFORCEMENT and herein. Conventional smooth "paving" dowels shall be installed in slabs using approved methods to hold the dowel in place during concreting within a maximum alignment tolerance of 1 mm in 100 mm. "Structural" type deformed bar dowels, or tie bars, shall be installed to meet the specified tolerances. Care shall be taken during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel or tie bar and that the concrete completely embeds the dowel or tie bar and is thoroughly consolidated.

3.6 FINISHING FORMED SURFACES

Forms, form materials, and form construction are specified in Section 03100 STRUCTURAL CONCRETE FORMWORK. Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Unless painting of surfaces is required, uniform color of the concrete shall be maintained by use of only one mixture without changes in materials or proportions for any

structure or portion of structure that requires a Class A or B finish. Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of ACI 117/117R. These tolerances apply to the finished concrete surface, not to the forms themselves; forms shall be set true to line and grade. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs shall be a blend of job cement with white cement proportioned so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable and free from cracks or loose or drummy areas at the completion of the contract and, for Class A and B Finishes, shall be inconspicuous. Repairs not meeting these requirements will be rejected and shall be replaced.

3.6.1 Class A Finish and Class B Finish

Class A and Class B finishes are required where surfaces are exposed to public view. Fins, ravelings, and loose material shall be removed, all surface defects over 12 mm in diameter or more than 12 mm deep, shall be repaired and, except as otherwise indicated or as specified in Section 03100

STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Defects more than 12 mm in diameter shall be cut back to sound concrete, but in all cases at least 25 mm deep. The Contractor shall prepare a sample panel for approval (as specified in PART 1) before commencing repair, showing that the surface texture and color match will be attained. Metal tools shall not be used to finish repairs in Class A surfaces.

3.6.2 Class C and Class D Finish

Class C finish is required at concealed surfaces not exposed to view. (All surfaces not covered by Class A, B or D finish.) Class D finish is required in the following areas, foundation footings. Fins, ravelings, and loose material shall be removed, and, except as otherwise indicated or as specified in Section 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Honeycomb and other defects more than 12 mm deep or more than 50 mm in diameter shall be repaired. Defects more than 50 mm in diameter shall be cut back to sound concrete, but in all cases at least 25 mm deep.

3.7 REPAIRS

3.7.1 Damp-Pack Mortar Repair

Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter but not over 100 mm shall be repaired by

the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the 1.18 mm sieve, and minimum amount of water. Only sufficient water shall be used to produce a mortar which, when used, will stick together on being molded into a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to 45 minutes before use with remixing performed immediately prior to use. Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured for at least 48 hours.

3.7.2 Repair of Major Defects

Major defects will be considered to be those more than 12 mm deep or, for Class A and B finishes, more than 12 mm in diameter and, for Class C and D finishes, more than 50 mm in diameter. Also included are any defects of any kind whose depth is over 100 mm or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

3.7.2.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose the reinforcement for at least 50 mm on all sides. All such defective areas greater than 7800 square mm shall be outlined by saw cuts at least 25 mm deep. Defective areas less than 7800 square mm shall be outlined by a 25 mm deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by high pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Contracting Officer's representative, immediately before completion of the contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-pressure stream, as approved. Repairs made using shotcrete equipment will not be accepted.

The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Burlap shall be kept continually wet.

3.7.2.2 Repair of Deep and Large Defects

Deep and large defects will be those that are more than 150 mm deep and also have an average diameter at the surface more than 450 mm or that are otherwise so identified by the Project Office. Such defects shall be removed and replaced.

3.8 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces shall meet the requirements of paragraph Tolerances in PART 1, when tested as specified herein.

3.8.1 General

The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed shall be not less than 10 degrees C. In hot weather all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage, as directed. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any slabs with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

3.8.2 Rough Slab Finish

As a first finishing operation for unformed surfaces and as final finish

for slabs to receive mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes, the surface shall receive a rough slab finish prepared as follows. The concrete shall be uniformly placed across the slab area, consolidated as previously specified, and then screeded with straightedge strikeoffs immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible. Side forms and screed rails shall be provided, rigidly supported, and set to exact line and grade. Allowable tolerances for finished surfaces apply only to the hardened concrete, not to forms or screed rails. Forms and screed rails shall be set true to line and grade. "Wet screeds" shall not be used.

3.8.3 Floated Finish

Slabs to receive more than a rough slab finish shall next be given a wood float finish. The screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. Then, after the concrete has stiffened so that it will withstand a man's weight without imprint of more than 6 mm and the water sheen has disappeared, it shall be floated to a true and even plane free of ridges. Floating shall be performed by use of suitable hand floats or power driven equipment. Sufficient pressure shall be used on the floats to bring a film of moisture to the surface. Hand floats shall be made of wood, magnesium, or aluminum. Concrete that exhibits stickiness shall be floated with a magnesium float. Care shall be taken to prevent over-finishing or incorporating water into the surface.

3.8.4 Troweled Finish

Slab surfaces exposed to view or to be coved with resilient flooring, carpet, ceramic, or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system shall be given a trowel finish. After floating is complete and after the surface moisture has disappeared, unformed surfaces shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. Additional trowelings shall be performed, either by hand or machine until the surface has been troweled 2, 3, or 4 times, with waiting period between each. Care shall be taken to prevent blistering and if such occurs, troweling shall immediately be stopped and operations and surfaces corrected. A final hard steel troweling shall be done by hand, with the trowel tipped, and using hard pressure, when the surface is at a point that the trowel will produce a ringing sound. The finished surface shall be thoroughly consolidated and shall be essentially free of trowel marks and be uniform in texture and appearance. The concrete mixture used for troweled finished areas shall be adjusted, if necessary, in order to provide sufficient fines (cementitious material and fine sand) to finish properly.

3.8.5 Non-Slip Finish

Non-slip floors shall be constructed in accordance with the following subparagraphs.

3.8.5.1 Broomed

Exterior concrete platforms, steps and ramps, and elsewhere as indicated shall be given a broomed finish. After floating, the surface shall be lightly steel troweled, and then carefully scored by pulling a coarse fiber push-type broom across the surface. Brooming shall be transverse to traffic or at right angles to the slope of the slab. After the end of the curing period, the surface shall be vigorously broomed with a coarse fiber broom to remove all loose or semi-detached particles.

3.8.5.2 Abrasive Aggregate

Areas as indicated on the drawings shall be given an abrasive aggregate finish. The concrete surface shall be given a float finish. Abrasive aggregate shall then immediately be uniformly sprinkled over the floated surface at a total rate of not less than 1.25 kg per square meter spread in two applications at right angles to each other. The surface shall then be troweled to a smooth, even finish that is uniform in texture and appearance and free from blemishes including trowels marks. Immediately after curing, cement paste and laitance covering the abrasive aggregate shall be removed by steel brushing, rubbing with abrasive stone, or sandblasting to expose the abrasive particles.

3.9 CURING AND PROTECTION

3.9.1 General

Concrete shall be cured by an approved method for the period of time given below:

Concrete with Type III cement	3 days
All other concrete	7 days

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water for the duration of the curing period. Air and forms in contact with concrete shall be maintained at a temperature above 10 degrees C for the first 3 days and at a temperature above 0 degrees C for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure, and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except as otherwise permitted by paragraph Membrane Forming Curing Compounds, moist curing shall be provided for any areas to receive floor hardener, any paint or other applied coating, or to which other concrete is to be bonded.

Concrete containing silica fume shall be initially cured by fog misting during finishing, followed immediately by continuous moist curing. Except for plastic coated burlap, impervious sheeting alone shall not be used for curing.

3.9.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. If water or curing materials used stain or discolor concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned as approved. When wooden forms are left in place during curing, they shall be kept wet at all times. If steel forms are used in hot weather, nonsupporting vertical forms shall be broken loose from the concrete soon after the concrete hardens and curing water continually applied in this void. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. The Contractor shall have an approved work system to ensure that moist curing is continuous 24 hours per day.

3.9.3 Ponding or Immersion

Concrete shall be continually immersed throughout the curing period. Water shall not be more than 10 degrees C less than the temperature of the concrete.

3.9.4 Cold Weather Curing and Protection

When the daily ambient low temperature is less than 0 degrees C the temperature of the concrete shall be maintained above 5 degrees C for the first seven days after placing. During the period of protection removal, the air temperature adjacent to the concrete surfaces shall be controlled so that concrete near the surface will not be subjected to a temperature differential of more than 13 degrees C as determined by suitable temperature measuring devices furnished by the Contractor, as required, and installed adjacent to the concrete surface and 50 mm inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor as directed.

3.10 SETTING BASE PLATES AND BEARING PLATES

After being properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates shall be set to the proper line and elevation with damp-pack bedding mortar, except where nonshrink grout is indicated. The thickness of the mortar or grout shall be approximately 1/24 the width of the plate, but not less than 20 mm. Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed. Nonshrink grout shall be used for column base plates (optional).

3.10.1 Damp-Pack Bedding Mortar

Damp-pack bedding mortar shall consist of 1 part cement and 2-1/2 parts fine aggregate having water content such that a mass of mortar tightly

squeezed in the hand will retain its shape but will crumble when disturbed.

The space between the top of the concrete and bottom of the bearing plate or base shall be packed with the bedding mortar by tamping or ramming with a bar or rod until it is completely filled.

3.10.2 Nonshrink Grout

Nonshrink grout shall be a ready-mixed material requiring only the addition of water. Water content shall be the minimum that will provide a flowable mixture and completely fill the space to be grouted without segregation, bleeding, or reduction of strength.

3.10.2.1 Mixing and Placing of Nonshrink Grout

Mixing and placing shall be in conformance with the material manufacturer's instructions and as specified therein. Ingredients shall be thoroughly dry-mixed before adding water. After adding water, the batch shall be mixed for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Grout not used within 30 minutes after mixing shall be discarded. The space between the top of the concrete or machinery-bearing surface and the plate shall be filled solid with the grout. Forms shall be of wood or other equally suitable material for completely retaining the grout on all sides and on top and shall be removed after the grout has set. The placed grout shall be carefully worked by rodding or other means to eliminate voids; however, overworking and breakdown of the initial set shall be avoided. Grout shall not be retempered or subjected to vibration from any source. Where clearances are unusually small, placement shall be under pressure with a grout pump. Temperature of the grout, and of surfaces receiving the grout, shall be maintained at 18 to 30 degrees C until after setting.

3.10.2.2 Treatment of Exposed Surfaces

For metal-oxidizing nonshrink grout, exposed surfaces shall be cut back 25 mm and immediately covered with a parge coat of mortar consisting of 1 part portland cement and 2-1/2 parts fine aggregate by weight, with sufficient water to make a plastic mixture. The parge coat shall have a smooth finish. For other mortars or grouts, exposed surfaces shall have a smooth-dense finish and be left untreated. Curing shall comply with paragraph CURING AND PROTECTION.

3.11 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and shall submit specified reports. When, in the opinion of the Contracting Officer, the concreting operation is out of control, concrete placement shall cease and the operation shall be corrected. The laboratory performing the tests shall be onsite and shall conform with ASTM C 1077. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per as determined by the Contracting Officer thereafter for conformance with ASTM

C 1077.

3.11.1 Grading and Corrective Action

3.11.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with ASTM C 136 and COE CRD-C 104 for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall immediately be reported to the Contracting Officer, concreting shall be stopped, and immediate steps taken to correct the grading.

3.11.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with ASTM C 136 for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control.

However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and shall be reported to the Contracting Officer. Concreting shall be stopped and immediate steps shall be taken to correct the grading.

3.11.2 Quality of Aggregates

Thirty days prior to the start of concrete placement, the Contractor shall perform all tests for aggregate quality required by ASTM C 33. In addition, after the start of concrete placement, the Contractor shall perform tests for aggregate quality at least every three months, and when the source of aggregate or aggregate quality changes. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

3.11.3 Scales, Batching and Recording

The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every three months. Such tests

shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. At the same time, the Contractor shall test and ensure that the devices for dispensing admixtures are operating properly and accurately. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

3.11.4 Batch-Plant Control

The measurement of concrete materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate weights and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. A report shall be prepared indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water weights per cubic meter, amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic meter for each class of concrete batched during each day's plant operation.

3.11.5 Concrete Mixture

- a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Tests shall be made in accordance with ASTM C 231 for normal weight concrete and ASTM C 173 for lightweight concrete. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate control chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph Air Entrainment. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between

each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content may be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the air content at the mixer controlled as directed.

- b. Air Content Corrective Action. Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to ensure that it is operating accurately and with good reproducibility. Whenever a point on either control chart reaches an action limit line, the air content shall be considered out of control and the concreting operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when concreting is restarted.
- c. Slump Testing. In addition to slump tests which shall be made when test specimens are fabricated, at least four slump tests shall be made on randomly selected batches in accordance with ASTM C 143/C 143M for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control charts for slump and the chart for range, and for determining need for any remedial action. Limits shall be set on separate control charts for slump for each type of mixture. The upper warning limit shall be set at 12.5 mm below the maximum allowable slump specified in paragraph Slump in PART 1 for each type of concrete and an upper action limit line and lower action limit line shall be set at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 50 mm. Samples for slump shall be taken at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated

slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the slump at the mixer controlled as directed.

- d. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an adjustment shall immediately be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c ratio specified, based on aggregates which are in a saturated surface dry condition. When a single slump reaches the upper or lower action limit, no further concrete shall be delivered to the placing site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch weights, produce a point on the control chart for range at or above the upper action limit, the concreting operation shall immediately be halted, and the Contractor shall take appropriate steps to bring the slump under control. Additional slump tests shall be made as directed.
- e. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064/C 1064M. The temperature shall be reported along with the compressive strength data.
- f. Strength Specimens. At least one set of test specimens shall be made, for compressive or flexural strength as appropriate, on each different concrete mixture placed during the day for each 380 cubic meters or portion thereof of that concrete mixture placed each day. Additional sets of test specimens shall be made, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. A truly random (not haphazard) sampling plan shall be developed by the Contractor and approved by the Contracting Officer prior to the start of construction. The plan shall assure that sampling is done in a completely random and unbiased manner. A set of test specimens for concrete with a 28-day specified strength per paragraph Strength Requirements in PART 1 shall consist of four specimens, two to be tested at 7 days and two at 28 days. Test specimens shall be molded and cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39/C 39M for test cylinders and ASTM C 78 for test beams. Results of all strength tests shall be reported immediately to the Contracting Officer. Quality control charts shall be kept for individual strength "tests", ("test" as defined in paragraph Strength Requirements in PART 1) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. The charts shall be similar to those found in ACI 214.3R.

3.11.6 Inspection Before Placing

Foundations, construction joints, forms, and embedded items shall be inspected by the Contractor in sufficient time prior to each concrete placement in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

3.11.7 Placing

The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

3.11.8 Vibrators

The frequency and amplitude of each vibrator shall be determined in accordance with COE CRD-C 521 prior to initial use and at least once a month when concrete is being placed. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing. Any vibrator not meeting the requirements of paragraph Consolidation, shall be immediately removed from service and repaired or replaced.

3.11.9 Curing Inspection

- a. Moist Curing Inspections. At least once each shift, and not less than twice per day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.
- b. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by 1 day.
- c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, the

Contractor shall estimate the quantity of compound used by measurement of the container and the area of concrete surface covered, shall compute the rate of coverage in square meters per Liter, and shall note whether or not coverage is uniform.

- d. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

3.11.10 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.11.11 Mixer Uniformity

- a. Stationary Mixers. Prior to the start of concrete placing and once every 6 months when concrete is being placed, or once for every 60,000 cubic meters of concrete placed, whichever results in the shortest time interval, uniformity of concrete mixing shall be determined in accordance with ASTM C 94/C 94M.
- b. Truck Mixers. Prior to the start of concrete placing and at least once every 6 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with ASTM C 94/C 94M. The truck mixers shall be selected randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.
- c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved.

3.11.12 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

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SECTION 03930

SPECIAL CONCRETE FINISHES

09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. All the latest versions of the referenced publications shall be used.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 779/31M	Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces
ASTM C 805	Impact Strength
ASTM G 23	Ultraviolet Light & Water Spray

AMERICAN CONCRETE INSTITUTE

ACI 302	Guide for Concrete Floor and Slab Construction
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1.2 SUBMITTALS

Comply with pertinent provisions of Section 01330 SUBMITTAL PROCEDURES. Provide submittal information 60 calendar days before the contractor will place the product.

SD-03 Product Data

Special concrete finishes manufacturer's specifications and test data; G RE

Product Description; G RE

Provide manufacturer's name and product name for the specified material proposed to be provided under this section.

Installation Procedures; G RE

Submit special concrete finishes manufacturer's recommended installation procedures; which when approved by the Contracting Officer, will become the basis for accepting or rejecting actual installation procedures used on the work. Follow all special concrete finishes published manufacturer's installation instructions.

Technical Data

Submit special concrete finishes technical data sheet giving descriptive data, curing time, and application requirements.

Material Safety Data Sheet (MSDS)

Submit special concrete finishes manufacturer's Material Safety Data Sheet (MSDS) and other safety requirements.

SD-07 Certificates

Letter of Certification

Provide letter of certification from concrete finish manufacturer stating that installer is certified applicator of special concrete finishes, and is familiar with proper procedures and installation requirements required by the manufacturer.

1.3 QUALITY ASSURANCE

1.3.1 Installer Qualifications

Use an experienced installer and adequate number of skilled workmen who are thoroughly trained and experienced in the necessary craft. The special concrete finish manufacturer shall certify applicator. Applicator shall be familiar with the specified requirements and the methods needed for proper performance of work of this section.

1.3.2 Mock-ups

Apply mock-ups of each type of finish, to demonstrate typical joints, surface finish, color variation (if any), and standard of workmanship.

- a. Build mock-ups approximately 15.24 sq m at site, as directed by the Contracting Officer.
- b. Notify Contracting Officer seven days in advance of dates and times when mock-ups will be constructed.
- c. Obtain from the Contracting Officer approval of mock-ups before starting construction.
- d. If the Contracting Officer determines that mock-ups do not meet requirements, demolish and remove them from the site and cast others until mock-ups are approved.
- e. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work.
- f. Approved mock-ups may become part of the completed work if undisturbed at time of substantial completion.

1.3.3 Protection

No satisfactory chemical or cleaning procedure is available to remove petroleum stains from the concrete surface. Prevention is therefore essential.

- a. All hydraulic powered equipment must be diapered to avoid staining of the concrete.
- b. No trade will park vehicles on the inside slab. If necessary to complete their scope of work, drop cloths will be placed under vehicles at all times.
- c. No pipe cutting machine will be used on the inside floor slab.
- d. Steel will not be placed on interior slab to avoid rust staining.

1.4 DELIVERY, STORAGE, AND HANDLING

Delivery materials in original containers, with seals unbroken, bearing manufacturer labels indicating brand name and directions for storage. Dispense special concrete finish material from factory numbered and sealed containers. Maintain record of container numbers.

1.5 ENVIRONMENTAL CONDITIONS

1.5.1 Environmental Limitations

Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting topping performance.

- a. Concrete must have a Floor Flatness rating of at least 50.
- b. Concrete must have a Floor Levelness rating of at least 50.
- c. Concrete must be cured a minimum of 45 days or as directed by the manufacturer before applications of Retro Plate can begin.
- d. Application of Retro-Plate shall take place 10 days prior to installation of equipment and substantial completion, thus providing a complete, uninhibited concrete slab for application.

1.5.2 Traffic control

Close areas to traffic during floor application and after application, for time period recommended in writing by manufacturer.

PART 2 PRODUCTS

2.1 HARDENING/SEALING AGENT

2.1.1 Retro-Plate 99

Manufactured by Advanced Floor Products, Inc., PO Box 50533, Provo, Utah 84605, 801-812-3420; or equal.

2.1.1.1 Performance Criteria

ASTM C 779/31M, up to 400% increase in abrasion resistance. ASTM C 805, up to 21% increase impact strength. ASTM G 23, no adverse effect to ultra violet and water spray. Up to 30% increase in reflectivity.

2.2 RELATED MATERIALS

Tri-sodium phosphate as neutralizing agent. Potable water.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

3.1.1 Substrate

In accordance with ACI 302 examine substrate, with installer present, for conditions affecting performance of finish. Correct conditions detrimental to timely and proper work. Do not proceed until unsatisfactory conditions are corrected.

3.1.2 Base Slab

Verify that base slab meets finish and surface profile requirements in Division 3 Section "Cast-In-Place Structural Concrete", and project conditions above.

3.1.3 Floor Surfaces

Prior to application, verify that floor surfaces are free of construction latents.

3.2 EXECUTION

3.2.1 Application

Include the manufacturer's technical representative in the mock-up review.

3.2.2 Sealing, Hardening and Polishing of Concrete Surface

- a. Concrete must be in place a minimum of 45 days or as directed by the manufacturer before application can begin.
- b. Application is to take place at least 10 days prior to equipment and other accessory installation, thus providing a complete, uninhibited concrete slab for application.
- c. Only a certified applicator shall apply Retro-Plate 99. Applicable procedures must be followed as recommended by the product manufacturer and as required to match approved test sample.

- d. Achieve waterproofing, hardening, dust-proofing, and abrasion resistance of the surface without changing the natural appearance of the concrete, except for the sheen.
- e. Polish to required sheen level.

3.2.3 Workmanship and Cleaning

- a. The premises shall be kept clean and free of debris at all times.
- b. Remove spatter from adjoining surfaces, as necessary.
- c. Repair damage to surface caused by cleaning operations.
- d. Remove debris from jobsite. Dispose of materials in separate, closed containers in accordance with local regulations.

3.3 PROTECTION

Protect finished work until fully cured in accordance with manufacturer's recommendations.

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SECTION 04200A

MASONRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI SP-66 (1994) ACI Detailing Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 951	Specification for Masonry Joint Reinforcement
ASTM C 62	(2000) Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 67	(2000) Sampling and Testing Brick and Structural Clay Tile
ASTM A 82	(1997a) Steel Wire, Plain, for Concrete Reinforcement
ASTM C 90	(2000) Loadbearing Concrete Masonry Units
ASTM C 91	(1999) Masonry Cement
ASTM C 140	(1999b) Sampling and Testing Concrete Masonry Units
ASTM A 153/A 153M	(2000) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM C 216	(2000) Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 270	(2000) Mortar for Unit Masonry
ASTM C 476	(1999) Grout for Masonry
ASTM C 494/C 494M	(1999a) Chemical Admixtures for Concrete
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM A 615M	(2000) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM C 641	(1982; R 1998el) Staining Materials in Lightweight Concrete Aggregates
ASTM C 780	(2000) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM A 951	(1996) Specification for Masonry Joint Reinforcement
ASTM C 1019	(2000) Sampling and Testing Grout
ASTM C 1072	(2000) Measurement of Masonry Flexural Bond Strength
ASTM C 1289	(1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D 2000	(1999) Rubber Products in Automotive Applications
ASTM D 2240	(2000) Rubber Property - Durometer Hardness
ASTM D 2287	(1996a) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-02 Shop Drawings

Masonry Work; G A/E

Drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; and wall openings. Bar splice locations shall be shown. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. The minimum scale for wall elevations shall be 1 to 50. Reinforcement bending details shall conform to the requirements of ACI SP-66.

SD-03 Product Data

Face Brick; G ~~REA/E~~
Concrete Brick; G ~~REA/E~~

Manufacturer's descriptive data.

Cold Weather Installation

Cold weather construction procedures.

SD-04 Samples

Concrete Masonry Units (CMU)
Face Brick

Color samples of three stretcher units and one unit for each type of special shape. Units shall show the full range of color and texture.

Anchors, Ties, and Bar Positioners

Two of each type used.

Expansion-Joint Material

One piece of each type used.

Joint Reinforcement

One piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

Portable Panel

One panel of face brick, 600 by 600 mm, containing approximately 24 brick facings to establish range of color and texture.

SD-06 Test Reports

Efflorescence Test
Field Testing of Mortar
Field Testing of Grout
Prism tests
Mortar
Fire-rated CMU

Test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project.

SD-07 Certificates

Face Brick
Concrete Masonry Units (CMU)
Control Joint Keys
Anchors, Ties, and Bar Positioners
Expansion-Joint Materials
Joint Reinforcement

Reinforcing Steel Bars and Rods
Mortar
Mortar Admixtures
Grout Admixtures

Certificates of compliance stating that the materials meet the specified requirements.

1.3 SAMPLE MASONRY PANELS

After material samples are approved and prior to starting masonry work, sample masonry panels shall be constructed for each type and color of masonry required. At least 48 hours prior to constructing the sample panel or panels, the Contractor shall submit written notification to the Contracting Officer's Representative. Sample panels shall not be built in, or as part of the structure, but shall be located where directed.

1.3.1 Configuration

Panels shall be L-shaped or otherwise configured to represent all of the wall elements. Panels shall be of the size necessary to demonstrate the acceptable level of workmanship for each type of masonry represented on the project. The minimum size of a straight panel or a leg of an L-shaped panel shall be 2.5 m long by 1.8 m high.

1.3.2 Composition

Panels shall show full color range, texture, and bond pattern of the masonry work. The Contractor's method for mortar joint tooling; grouting of reinforced vertical cores, collar joints, bond beams, and lintels; positioning, securing, and lapping of reinforcing steel; positioning and lapping of joint reinforcement (including prefabricated corners); and cleaning of masonry work shall be demonstrated during the construction of the panels. Installation or application procedures for anchors, wall ties, CMU control joints, brick expansion joints, insulation, flashing, brick soldier, row lock courses and weep holes shall be shown in the sample panels. The panels shall contain a masonry bonded corner that includes a bond beam corner. Panels shall show installation of electrical boxes and conduit. Panels that represent reinforced masonry shall contain a 600 by 600 mm opening placed at least 600 mm above the panel base and 600 mm away from all free edges, corners, and control joints. Required reinforcing shall be provided around this opening as well as at wall corners and control joints.

1.3.3 Construction Method

Where anchored veneer walls are required, the Contractor shall demonstrate and receive approval for the method of construction; i.e., either bring up the two wythes together or separately, with the insulation and appropriate ties placed within the specified tolerances across the cavity. Temporary provisions shall be demonstrated to preclude mortar or grout droppings in the cavity and to provide a clear open air space of the dimensions shown on the drawings. Where masonry is to be grouted, the Contractor shall demonstrate and receive approval on the method that will be used to bring up the masonry wythes; support the reinforcing bars; and grout cells, bond beams and lintels using the requirements specified herein. If sealer is specified to be applied to the masonry units, sealer shall be applied to the sample panels. Panels shall be built on a properly designed concrete foundation.

1.3.4 Usage

The completed panels shall be used as the standard of workmanship for the type of masonry represented. Masonry work shall not commence until the sample panel for that type of masonry construction has been completed and approved. Panels shall be protected from the weather and construction operations until the masonry work has been completed and approved. After completion of the work, the sample panels, including all foundation concrete, shall become the property of the Contractor and shall be removed from the construction site.

1.4 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material.

1.4.1 Masonry Units

Concrete masonry units shall be covered or protected from inclement weather. In addition, they shall conform to the moisture content specified in ASTM C 90 when delivered to the jobsite. Prefabricated lintels shall be marked on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.4.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

1.4.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.

2.2 FACE BRICK

Color range and texture of face brick shall be as indicated and shall conform to the approved sample. Grade SW, Type FBS shall be used for brick in contact with earth or grade and for all exterior work. Grade SW or MW, Type FBS shall be used in other brickwork. Brick shall be tested for efflorescence. Face brick units shall be delivered factory-blended to provide a uniform appearance and color range in the completed wall.

2.2.1 Solid Face Brick

Solid face brick shall conform to ASTM C 216. Brick size shall be modular and the nominal size of the brick used shall be 57 mm thick, 92 mm wide, and 200 mm long. Minimum compressive strength of the brick shall be 20.7 MPa.

2.3 CONCRETE MASONRY UNITS (CMU)

Hollow and solid concrete masonry units shall conform to ASTM C 90. Cement shall have a low alkali content and be of one brand.

2.3.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

2.3.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners except at door, window, and louver jambs, unless noted otherwise. Radius of the bullnose shall be 25 mm. Units used in exposed masonry surfaces shall have a uniform fine to medium texture and a uniform color.

2.3.3 Fire-Rated CMU

Concrete masonry units used in fire-rated construction shown on the drawings shall be of minimum equivalent thickness for the fire rating indicated and the corresponding type of aggregates indicated in TABLE I. Units containing more than one of the aggregates listed in TABLE I will be rated on the aggregate requiring the greater minimum equivalent thickness to produce the required fire rating.

TABLE I

FIRE-RATED CONCRETE MASONRY UNITS

See note (a) below

Aggregate Type	Minimum equivalent thickness in mm (inches) for fire rating of:		
	4 hours	3 hours	2 hours
Pumice	120 (4.7)	100 (4.0)	75 (3.0)
Expanded slag	130 (5.0)	110 (4.2)	85 (3.3)
Expanded clay, shale, or slate	145 (5.7)	120 (4.8)	95 (3.7)
Limestone, scoria, cinders or unexpanded slag	150 (5.9)	130 (5.0)	100 (4.0)

TABLE I
FIRE-RATED CONCRETE MASONRY UNITS

See note (a) below

Calcareous gravel	160 (6.2)	135 (5.3)	105 (4.2)
Siliceous gravel	170 (6.7)	145 (5.7)	115 (4.5)

(a) Minimum equivalent thickness shall equal net volume as determined in conformance with ASTM C 140 divided by the product of the actual length and height of the face shell of the unit in millimeters. Where walls are to receive plaster or be faced with brick, or otherwise form an assembly; the thickness of plaster or brick or other material in the assembly will be included in determining the equivalent thickness.

2.4 Packing (Backer Rods)

Polyethylene foam, neoprene, or filler shall be as recommended by the sealant manufacturer.

2.5 MORTAR

Mortar shall be Type S in accordance with the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate; when masonry cement ASTM C 91 is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Verification of masonry cement performance shall be based on ASTM C 780 and ASTM C 1072. Pointing mortar in showers and kitchens shall contain ammonium stearate, or aluminum tri-stearate, or calcium stearate in an amount equal to 3 percent by weight of cement used. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source. Mortar shall be plain masonry gray.

2.5.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C.

2.6 GROUT

Grout shall conform to ASTM C 476. Cement used in grout shall have a low alkali content. Grout slump shall be between 200 and 250 mm. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements.

2.6.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C

494M, Type C.

2.6.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

2.7 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A 153/A 153M, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A 82. Anchors and ties shall be sized to provide a minimum of 16 mm mortar cover from either face.

2.7.1 Wall Ties

Wall ties shall be rectangular-shaped or Z-shaped fabricated of 5 mm diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 100 mm wide. Adjustable type wall ties shall consist of two essentially U-shaped elements fabricated of 5 mm diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 13 mm eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 2 mm. The pintle and eye elements shall be formed so that both can be in the same plane.

2.7.2 Adjustable Anchors

Adjustable anchors shall be 5 mm diameter steel wire, triangular-shaped. Anchors attached to steel shall be 8 mm diameter steel bars placed to provide 2 mm play between flexible anchors and structural steel members. Spacers shall be welded to rods and columns. Equivalent welded-on steel anchor rods or shapes standard with the flexible-anchor manufacturer may be furnished when approved. Welds shall be cleaned and given one coat of zinc-rich touch up paint.

2.7.3 Anchors for Connecting to Concrete

Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section: Dovetail anchor section formed from 1.35 mm thick, steel sheet, galvanized after fabrication.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 25 mm of masonry face, made from 6.4 mm diameter, hot-dip galvanized steel wire.

2.7.4 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

2.8 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming

to ASTM A 951, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A 153/A 153M, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be truss type design, having one longitudinal wire in the mortar bed of each face shell for hollow units. Joint reinforcement shall be placed a minimum of 16 mm cover from either face. The distance between crosswires shall not exceed 400 mm. Joint reinforcement for straight runs shall be furnished in flat sections not less than 3 m long. Joint reinforcement shall be provided with factory formed corners and intersections.

2.8.1 Multiwythe Masonry

Provide adjustable (2-piece) type with single pair of side rods and continuous diagonal cross ties spaced not more than 400 mm o.c. and with separate adjustable veneer ties engaging the cross ties. Cross ties are either U-shaped with eyes or rectangular. Space side rods for embedment within each face shell of backup wythe and size adjustable ties to extend at least halfway through outer wythe but with at least 15 mm cover on outside face. Use where facing wythe is of different material than backup wythe.

2.9 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A 615M, Grade 60.

2.10 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D 2000 or polyvinyl chloride conforming to ASTM D 2287. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than 16 mm thick and 10 mm thick flanges, with a tolerance of plus or minus 2 mm. The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of minus 34 degrees C after five hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with ASTM D 2240.

2.11 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07900 JOINT SEALING.

2.12 FLASHING

Flashing shall be as specified in Section 07600 FLASHING AND SHEET METAL.

PART 3 EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the

ambient air temperature is more than 37 degrees C in the shade and the relative humidity is less than 50 percent. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 1.2 m ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 4 degrees C, a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

3.1.2.1 Preparation

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

- a. Air Temperature 4 to 0 degrees C. Sand or mixing water shall be heated to produce mortar temperatures between 4 and 49 degrees C.
- b. Air Temperature 0 to minus 4 degrees C. Sand and mixing water shall be heated to produce mortar temperatures between 4 and 49 degrees C. Temperature of mortar on boards shall be maintained above freezing.
- c. Air Temperature minus 4 to minus 7 degrees C. Sand and mixing water shall be heated to provide mortar temperatures between 4 and 49 degrees C. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 24 km/hour.
- d. Air Temperature minus 7 degrees C and below. Sand and mixing water shall be heated to provide mortar temperatures between 4 and 49 degrees C. Enclosure and auxiliary heat shall be provided to maintain air temperature above 0 degrees C. Temperature of units when laid shall not be less than minus 7 degrees C.

3.1.2.2 Completed Masonry and Masonry Not Being Worked On

- a. Mean daily air temperature 4 to 0 degrees C. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.
- b. Mean daily air temperature 0 to minus 4 degrees C. Masonry shall be completely covered with weather-resistant membrane for 24 hours.
- c. Mean Daily Air Temperature minus 4 to minus 7 degrees C. Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.
- d. Mean Daily Temperature minus 7 degrees C and Below. Masonry temperature shall be maintained above 0 degrees C for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.2 LAYING MASONRY UNITS

Masonry units shall be laid in running bond pattern. Facing courses shall be level with back-up courses, except for adjustable ties, in which case the tolerances shall be plus or minus 13 mm. Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be selected from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 13 mm into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below. In double wythe construction, the inner wythe may be brought up not more than 400 mm ahead of the outer wythe. Collar joints below grade shall be filled with mortar or grout during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by more than 200 mm.

3.2.1 Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 3 mm. Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

3.2.2 Forms and Shores

Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved.

3.2.4 Brick Units

Brick facing shall be laid with the finished face exposed. Brick shall be

laid in running bond with each course bonded at corners, unless otherwise indicated. Brick that is cored, recessed, or has other deformations may be used in sills, treads, soldier courses, except where deformations will be exposed to view.

3.2.4.1 Wetting of Units

Wetting of clay, shale brick, or hollow brick units having an initial rate of absorption of more than 0.155 gm per minute per square cm (1 gm per minute per square inch) of bed surface shall be in conformance with ASTM C 67. The method of wetting shall ensure that each unit is nearly saturated but surface dry when laid.

3.2.4.2 Solid Units

Bed, head, and collar joints shall be completely filled with mortar.

3.2.4.3 Hollow Units

Hollow units shall be laid as specified for concrete masonry units.

3.2.5 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

TABLE II

TOLERANCES

Variation from the plumb in the lines
and surfaces of columns, walls and arises

In adjacent masonry units	3 mm
In 3 m	6 mm
In 6 m	10 mm
In 12 m or more	13 mm

Variations from the plumb for external corners,
expansion joints, and other conspicuous lines

In 6 m	6 mm
In 12 m or more	13 mm

Variations from the level for exposed lintels,
sills, parapets, horizontal grooves, and other
conspicuous lines

In 6 m	6 mm
In 12 m or more	13 mm

Variation from level for bed joints and top
surfaces of bearing walls

TOLERANCES

In 3 m	6 mm
In 12 m or more	13 mm

Variations from horizontal lines

In 3 m	6 mm
In 6 m	10 mm
In 12 m or more	13 mm

Variations in cross sectional dimensions of columns and in thickness of walls

Minus	6 mm
Plus	13 mm

3.2.6 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 300 mm wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.7 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

3.2.7.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed joints.

3.2.7.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

3.2.7.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm.

3.2.8 Joint Widths

Joint widths shall be as follows:

3.2.8.1 Concrete Masonry Units

Concrete masonry units shall have 10 mm joints.

3.2.8.2 Brick

Brick joint widths shall be the difference between the actual and nominal dimensions of the brick in either height or length. Brick expansion joint widths shall be as shown.

3.2.9 Embedded Items

Spaces around built-in items shall be filled with mortar. Openings around flush-mount electrical outlet boxes in wet locations shall be pointed with mortar. Anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in shall be embedded as the masonry work progresses. Anchors, ties and joint reinforcement shall be fully embedded in the mortar. Cells receiving anchor bolts and cells of the first course below bearing plates shall be filled with grout.

3.2.10 Unfinished Work

Unfinished work shall be stepped back for joining with new work. Toothing may be resorted to only when specifically approved. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

3.2.11 Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

3.2.12 Partitions

Partitions shall be continuous from floor to underside of roof deck where shown. Openings in firewalls around joists or other structural members shall be filled as indicated or approved. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 100 mm above the ceiling level. An isolation joint shall be placed in the intersection between partitions and structural or exterior walls as shown. Interior partitions having 100 mm nominal thick units shall be tied to intersecting partitions of 100 mm units, 125 mm into partitions of 150 mm units, and 175 mm into partitions of 200 mm or thicker units. Cells within vertical plane of ties shall be filled solid with grout for full height of partition or solid masonry units

may be used. Interior partitions having masonry walls over 100 mm thick shall be tied together with joint reinforcement. Partitions containing joint reinforcement shall be provided with prefabricated pieces at corners and intersections or partitions.

3.3 ANCHORED VENEER CONSTRUCTION

The inner and outer wythes shall be completely separated by a continuous airspace as shown on the drawings. Both the inner and the outer wythes shall be laid up together except when adjustable joint reinforcement assemblies are approved for use. When both wythes are not brought up together, through-wall flashings shall be protected from damage until they are fully enclosed in the wall. When face brick is supported by cold-formed metal framing, wall ties shall be placed at 400 mm on center in each direction. The airspace between the wythes shall be kept clear and free of mortar droppings by temporary wood strips laid on the wall ties and carefully lifted out before placing the next row of ties. A coarse gravel or drainage material shall be placed behind the weep holes in the cavity to a minimum depth of 100 mm of coarse aggregate or 250 mm of drainage material to keep mortar droppings from plugging the weep holes.

3.4 WEEP HOLES

Weep holes shall be provided not more than 600 mm on centers in mortar joints of the exterior wythe above wall flashing, over foundations, bond beams, and any other horizontal interruptions of the cavity. Weep holes shall be formed by placing short lengths of well-greased No. 10, 8 mm nominal diameter, braided cotton sash cord in the mortar and withdrawing the cords after the wall has been completed. Other approved methods may be used for providing weep holes. Weep holes shall be kept free of mortar and other obstructions.

3.5 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours after mixing shall be discarded.

3.6 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 50 mm of tops of walls.

3.6.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 13 mm shall be maintained between the bars and masonry units. Minimum clearance between

parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

3.6.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

3.7 JOINT REINFORCEMENT

Joint reinforcement shall be installed at 400 mm on center or as indicated.

Reinforcement shall be lapped not less than 150 mm. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 16 mm cover to either face of the unit.

3.8 PLACING GROUT

Cells containing reinforcing bars shall be filled with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

3.8.1 Vertical Grout Barriers for Fully Grouted Walls

Grout barriers shall be provided not more than 10 m apart, or as required, to limit the horizontal flow of grout for each pour.

3.8.2 Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

3.8.3 Grout Holes and Cleanouts

3.8.3.1 Grout Holes

Grouting holes shall be provided in slabs, spandrel beams, and other in-place overhead construction. Holes shall be located over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Additional openings spaced not more than 400 mm on centers shall be provided where grouting of all hollow unit masonry is indicated. Openings shall not be less than 100 mm in diameter or 75 by 100 mm in horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

3.8.3.2 Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 1.5 m. Where all cells are to be grouted, cleanout courses shall be constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of 800 mm where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 75 by 100 mm openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.8.3.3 Cleanouts for Solid Unit Masonry Construction

Cleanouts for construction of walls consisting of a grout filled cavity between solid masonry wythes shall be provided at the bottom of every pour by omitting every other masonry unit from one wythe. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanout holes shall not be plugged until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.8.4 Grouting Equipment

3.8.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Pumps shall be operated to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, waste materials and debris shall be removed from the equipment, and disposed of outside the masonry.

3.8.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.

3.8.5 Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout shall not be placed in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of

grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 1.5 m in height. High-lift grout methods shall be used on pours exceeding 1.5 m in height.

3.8.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 13 mm into the grout space shall be removed before beginning the grouting operation. Grout pours 300 mm or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 300 mm in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

3.8.5.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 6 mm into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 1.2 m in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 300 to 450 mm into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (m) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (mm) (1,2)	
			Multiwythe Masonry (3)	Hollow-unit Masonry
0.3	Fine	Low Lift	20	40 x 50
1.5	Fine	Low Lift	50	50 x 75
2.4	Fine	High Lift	50	50 x 75
3.6	Fine	High Lift	65	65 x 75
7.3	Fine	High Lift	75	75 x 75
0.3	Coarse	Low Lift	40	40 x 75
1.5	Coarse	Low Lift	50	65 x 75
2.4	Coarse	High Lift	50	75 x 75
3.6	Coarse	High Lift	65	75 x 75
7.3	Coarse	High Lift	75	75 x 100

Notes:

- (1) The actual grout space or cell dimension must be larger than the sum of the following items:
 - a) The required minimum dimensions of total clear areas given in the table above;
 - b) The width of any mortar projections within the space;
 - c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.
- (2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 20 mm or greater in width.
- (3) For grouting spaces between masonry wythes.
- (4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.9 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 13 mm shall be maintained between reinforcement and interior faces of units.

3.10 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using sash jamb units with control joint key in accordance with the details shown on the drawings. Sash jamb units shall have a 19 by 19 mm (3/4 by

3/4 inch) groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of 20 mm; backer rod and sealant shall be installed in accordance with Section 07900 JOINT SEALING. Exposed interior control joints shall be raked to a depth of 6 mm. Concealed control joints shall be flush cut.

3.11 BRICK EXPANSION JOINTS AND CONCRETE MASONRY VENEER JOINTS

Brick expansion joints and concrete masonry veneer joints shall be provided and constructed as shown on the drawings. Joints shall be kept free of mortar and other debris.

3.12 LINTELS

3.12.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 16 bars in the bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 600 mm, whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 13 mm above the bottom inside surface of the lintel unit.

3.12.2 Steel Lintels

Steel lintels shall be as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel and precast lintels shall have a minimum bearing length of 200 mm unless otherwise indicated on the drawings.

3.13 SILLS AND COPINGS

Sills and copings shall be set in a full bed of mortar with faces plumb and true.

3.14 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

3.14.1 Anchorage to Concrete

Anchorage of masonry to the face of concrete columns, beams, or walls shall be with dovetail anchors spaced not over 400 mm on centers vertically and 600 mm on center horizontally.

3.14.2 Anchorage to Structural Steel

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 400 mm on centers vertically, and if applicable, not over 600 mm on centers horizontally.

3.15 INSULATION

Anchored veneer walls shall be insulated, where shown, by installing board-type insulation on the cavity side of the inner wythe. Board type insulation shall be applied directly to the masonry or thru-wall flashing

with adhesive. Insulation shall be neatly fitted between obstructions without impaling of insulation on ties or anchors. The insulation shall be applied in parallel courses with vertical joints breaking midway over the course below and shall be applied in moderate contact with adjoining units without forcing, and shall be cut to fit neatly against adjoining surfaces.

3.16 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashings shall be completely removed from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

3.16.1 Concrete Masonry Unit and Concrete Brick Surfaces

Exposed concrete masonry unit and concrete brick surfaces shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.16.2 Brick Surfaces

Exposed brick masonry surfaces shall be cleaned as necessary to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. After cleaning, the sample panel of similar material shall be examined for discoloration or stain as a result of cleaning. If the sample panel is discolored or stained, the method of cleaning shall be changed to assure that the masonry surfaces in the structure will not be adversely affected. The exposed masonry surfaces shall be water-soaked and then cleaned with a solution proportioned 30 mL trisodium phosphate and 30 mL laundry detergent to 1 L of water or cleaned with a proprietary masonry cleaning agent specifically recommended for the color and texture by the brick manufacturer. The solution shall be applied with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence shall be removed in conformance with the brick manufacturer's recommendations.

3.17 BEARING PLATES

Bearing plates for beams, joists, joist girders and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Bedding mortar and non-shrink grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.18 PROTECTION

Facing materials shall be protected against staining. Top of walls shall

be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 600 mm down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

3.19 TEST REPORTS

3.19.1 Field Testing of Mortar

At least three specimens of mortar shall be taken each day. A layer of mortar 13 to 16 mm thick shall be spread on the masonry units and allowed to stand for one minute. The specimens shall then be prepared and tested for compressive strength in accordance with ASTM C 780.

3.19.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C 1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 18 MPa at 28 days.

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SECTION 05120A

STRUCTURAL STEEL
09/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC FCD	(1995a) Quality Certification Program Description
AISC ASD Manual	(1989) Manual of Steel Construction Allowable Stress Design
AISC ASD/LRFD Vol II	(1992) Manual of Steel Construction Vol II: Connections
AISC Design Guide No. 10	(1989) Erection Bracing of Low-Rise Structural Steel Frames
AISC LRFD Vol I	(1995) Manual of Steel Construction Load & Resistance Factor Design, Vol I: Structural Members, Specifications & Codes
AISC LRFD Vol II	(1995) Manual of Steel Construction Load & Resistance Factor Design, Vol II: Structural Members, Specifications & Codes
AISC Pub No. S303	(1992) Code of Standard Practice for Steel Buildings and Bridges

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 6/A 6M	(1998a) General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A 36/A 36M	(1997a) Carbon Structural Steel
ASTM A 53	(1999) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 242/A 242M	(1998) High-Strength Low-Alloy Structural Steel
ASTM A 307	(1997) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASTM A 325	(1997) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 325M	(1997) High-Strength Bolts for Structural Steel Joints (Metric)
ASTM A 490	(1997) Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
ASTM A 490M	(1993) High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM A 500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(1999) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 502	(1993) Steel Structural Rivets
ASTM A 514/A 514M	(1994a) High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
ASTM A 529/A 529M	(1996) High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A 563	(1997) Carbon and Alloy Steel Nuts
ASTM A 563M	(1997) Carbon and Alloy Steel Nuts (Metric)
ASTM A 572/A 572M	(1999) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 588/A 588M	(1997) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM A 618	(1999) Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A 709/A 709M	(1997a) Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched-and-Tempered Alloy Structural Steel Plates for Bridges
ASTM A 852/A 852M	(1997) Quenched and Tempered Low-Alloy Structural Steel Plate with 70 ksi (485 MPa) Minimum Yield Strength to 4 in. (100 mm) Thick
ASTM A 992/A 992M	(1998e1) Steel for Structural Shapes For Use in Building Framing
ASTM F 436	(1993) Hardened Steel Washers

ASTM F 436M	(1993) Hardened Steel Washers (Metric)
ASTM F 844	(1998) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F 959	(1999) Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

ASME INTERNATIONAL (ASME)

ASME B18.21.1	(1994) Lock Washers (Inch Series)
ASME B46.1	(1995) Surface Texture (Surface Roughness, Waviness, and Lay)

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1998) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1	(1998) Structural Welding Code - Steel

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)
SSPC-SP3	Power Tool Cleaning
SSPC-SP6	Commercial Blast Cleaning
SSPC-SP11	Power Tool Cleaning to Bare Metal

1.2 GENERAL REQUIREMENTS

Structural steel fabrication and erection shall be performed by an organization experienced in structural steel work of equivalent magnitude. The Contractor shall be responsible for correctness of detailing, fabrication, and for the correct fitting of structural members. Connections, for any part of the structure not shown on the contract drawings, shall be considered simple shear connections and shall be designed and detailed in accordance with pertinent provisions of AISC ASD Manual and AISC LRFD Vol II. Substitution of sections or modification of connection details will not be accepted unless approved by the Contracting Officer. AISC ASD Manual and AISC ASD/LRFD Vol II shall govern the work. Welding shall be in accordance with AWS D1.1; except that welding for critical applications shall be in accordance with Section 05090 WELDING, STRUCTURAL or paragraph WELDING. High-strength bolting shall be in accordance with AISC ASD Manual.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office

that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-02 Shop Drawings

Structural Steel System; G, A/E
Structural Connections; G, A/E
Structural Connection Calculations; G, A/E

Structural calculations for connections indicated on drawings shall be signed and sealed by a qualified professional engineer in the state of Georgia

Shop and erection details including members (with their connections) not shown on the contract drawings. Welds shall be indicated by standard welding symbols in accordance with AWS A2.4.

SD-03 Product Data

Erection; G, REA/E

Prior to erection, erection plan of the structural steel framing describing all necessary temporary supports, including the sequence of installation and removal.

Welding; G, REA/E

WPS not prequalified.

WPS prequalified.

SD-04 Samples

High Strength Bolts and Nuts; G, REA/E
Carbon Steel Bolts and Nuts; G, REA/E
Nuts Dimensional Style; G, REA/E
Washers; G, REA/E

Random samples of bolts, nuts, and washers as delivered to the job site if requested, taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

SD-07 Certificates

Mill Test Reports; G, REA/E

Certified copies of mill test reports for structural steel, structural bolts, nuts, washers, twist-off tension control bolts (load indicator bolts) and other related structural steel items, including attesting that the structural steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified, prior to the installation.

Welder Qualifications; G, REA/E

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.1.

Welding Inspector; G, ~~REA/E~~

Welding Inspector qualifications.

Fabrication; G, ~~REA/E~~

A copy of the AISC certificate indicating that the fabrication plant meets the specified structural steelwork category.

1.4 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

1.5 WELDING INSPECTOR

Welding Inspector qualifications shall be in accordance with AWS D1.1

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

2.1.1 Carbon Grade Steel

Carbon grade steel shall conform to ASTM A 36/A 36M.

2.1.2 High-Strength Low-Alloy Steel

High-strength low-alloy steel shall conform to ASTM A 572/A 572M, Grade 50.

2.2 STRUCTURAL TUBING

Structural tubing shall conform to ASTM A 500, Grade C.

2.3 STEEL PIPE

Steel pipe shall conform to ASTM A 53, Type E or Type S, Grade B.

2.4 HIGH STRENGTH BOLTS AND NUTS

High strength bolts shall conform to ASTM A 325M, Type 1 with carbon steel nuts conforming to ASTM A 563M, Grade C and ASTM A 325M.

2.5 TENSION CONTROL BOLTS

ASTM A 325, Type 1, Heavy Hex Carbon-Steel Nuts, hardened carbon steel washers, and structural bolts with a notch between the bolt tap and threads. The bolt shall be designed to react to the opposing rotational torques applied by the installation wrench, with the bolt tip automatically shearing off when the proper tension is obtained.

2.6 CARBON STEEL BOLTS AND NUTS

Carbon steel bolts shall conform to ASTM A 307, Grade A with carbon steel nuts conforming to ASTM A 563M, Grade A.

2.7 NUTS DIMENSIONAL STYLE

Carbon steel nuts shall be Heavy Hex style when used with ASTM A 307 bolts

or Heavy Hex style when used with ASTM A 325M or ASTM A 490M bolts.

2.8 WASHERS

Plain washers shall conform to ASTM F 844.

2.9 PAINT/PRIMER

Primer for interior concealed steel shall conform to the following:

- a. Generic Type - Modified Alkyd, chemically active, rust-inhibiting pigment.
- b. Volume Solids - not less than 55%.
- c. Volatile Organic Compounds (VOC) - not more than 3.25 pounds per gallon (thinned 10%).
- d. Dry Film Thickness - 2.0 to 3.5 mils.
- e. Color - Gray.
- f. Adhesion - no less than a rating of 5 (ASTM D 3359, Method B).
- g. Salt Spray (Fog) - No blistering, cracking, rusting or delamination of film. No rust creepage after 500 hours exposure (ASTM B 117).

2.9.1 Primer

Primer for exterior steel and interior exposed steel shall conform to the following:

- a. Generic Type - Polyamidoamine Epoxy, lead- and chromate-free, corrosion inhibiting pigment.
- b. Volume Solids - not less than 70%.
- c. Volatile Organic Compounds (VOC) - not more than 2.90 pounds per gallon (thinned 10%).
- d. Dry Film Thickness - 2.0 to 4.0 mils.
- e. Color - Beige.
- f. Adhesion - no less than a rating of 5 (ASTM D 3359, Method B).
- g. Exterior Exposure - No blistering, cracking, rusting or delamination of film after 35,000 hours exterior exposure (one coat on prepared steel).
- h. Salt Spray (Fog) - No blistering, cracking, rusting or delamination of film. No rust creepage after 500 hours exposure (ASTM B 117).

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC ASD Manual. Fabrication and assembly shall be done in the shop to the greatest extent possible. The fabricating plant shall be certified under the AISC FCD for Category Conventional Steel Building Structures. Compression joints depending on contact bearing shall have a surface roughness not in excess of 13 micrometer as determined by ASME B46.1, and ends shall be square within the tolerances for milled ends specified in ASTM A 6/A 6M. Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, surfaces to be fireproofed, and contact surfaces of friction-type high-strength bolted connections shall be prepared for painting in accordance with endorsement "P" of AISC FCD and primed with the specified paint.

3.2 ERECTION

- a: Erection of structural steel, except as indicated in item b. below, shall be in accordance with the applicable provisions of AISC ASD Manual. Erection plan shall be reviewed, stamped and sealed by a structural engineer licensed by the state in which the project is located.
- b. For low-rise structural steel buildings (18 m tall or less and a maximum of 2 stories), the erection plan shall conform to AISC Pub No. S303 and the structure shall be erected in accordance with AISC Design Guide No. 10.

3.2.1 Structural Connections

Anchor bolts and other connections between the structural steel and foundations shall be provided and shall be properly located and built into connecting work. Field welded structural connections shall be completed before load is applied.

3.2.2 Base Plates and Bearing Plates

Column base plates for columns and bearing plates for beams, girders, and similar members shall be provided. Base plates and bearing plates shall be provided with full bearing after the supported members have been plumbed and properly positioned, but prior to placing superimposed loads. Separate setting plates under column base plates will not be permitted. The area under the plate shall be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Bedding mortar and grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.2.3 Field Priming

After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat. Prepare surfaces according to SSPC-SP6 or SSPC-SP11.

3.2.4 Shop Priming

Shop prime steel surfaces, except the following:

- a. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).

- b. Surfaces to be field welded.
- c. Surfaces to be high-strength bolted with slip-critical connections.
- d. Surfaces to receive sprayed-on fireproofing.
- f. Galvanized surfaces.

3.2.5 Surface Preparation

Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:

- a. SSPC-SP3 "Power Tool Cleaning."
- b. SSPC-SP6 "Commercial Blast Cleaning"

3.3 WELDING

The contractor shall develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Prequalified procedures may be submitted for information only; however, procedures that are not prequalified shall be submitted for approval.

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SECTION 05210A

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SECTION 05210A

STEEL JOISTS

11/88

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

STEEL JOIST INSTITUTE (SJI)

SJI Specs & Tables	(1994) Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-02 Shop Drawings

Steel Joists; G, A/E
Steel Joist Engineering Analysis Calculations; G, A/E

Detail drawings shall include fabrication and erection details, specifications for shop painting, and identification markings of joists. All joists shall comply with design loadings indicated on drawings, including structural analysis data signed and sealed by a qualified professional engineer in the state of Georgia responsible for their preparation.

SD-07 Certificates

Steel Joists; G ~~REA/E~~

Certificates stating that the steel joists have been designed and manufactured in accordance with SJI Specs & Tables. Complete engineering design computations may be submitted in lieu of the certification.

1.3 DESCRIPTION

Steel joists are designated on the drawings in accordance with the standard designations of the Steel Joist Institute. Joists of other standard designations or joists with properties other than those shown may be substituted for the joists designated provided the structural properties are equal to or greater than those of the joists shown and provided all

other specified requirements are met.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition and stored off the ground in a well drained location, protected from damage, and easily accessible for inspection and handling.

PART 2 PRODUCTS

2.1 OPEN WEB STEEL JOISTS

Open web steel joists shall conform to SJI Specs & Tables, K-Series. Joists shall be designed to support the loads given in the standard load tables of SJI Specs & Tables.

2.2 LONGSPAN STEEL JOISTS

LH-Series. Joists designated LH shall be designed to support the loads given in the applicable standard load tables of SJI Specs & Tables.

2.3 ACCESSORIES AND FITTINGS

Accessories and fittings, including end supports and bridging, shall be in accordance with the standard specifications under which the members were designed.

2.4 SHOP PAINTING

Joists and accessories shall be shop painted with a rust-inhibiting primer paint (gray alkyd). For joists which will be finish painted under Section 09900 PAINTING, GENERAL, the primer paint shall be limited to a primer which is compatible with the specified finish paint. Exterior exposed joist shall be primed with a primer with a very good resistance to exterior exposed atmospheric/weather corrosion.

PART 3 EXECUTION

3.1 ERECTION

Installation of joists shall be in accordance with the standard specification under which the member was produced. Joists shall be handled in a manner to avoid damage. Damaged joists shall be removed from the site, except when field repair is approved and such repairs are satisfactorily made in accordance with the manufacturer's recommendations. Joists shall be accurately set, and end anchorage shall be in accordance with the standard specification under which the joists were produced. For spans over 12 m through 18 m one row of bridging nearest midspan shall be bolted diagonal bridging; for spans over 18 m bolted diagonal bridging shall be used instead of welded horizontal bridging. Joist bridging and anchoring shall be secured in place prior to the application of any construction loads. Any temporary loads shall be distributed so that the carrying capacity of any joist is not exceeded. Loads shall not be applied to bridging during construction or in the completed work. Abraded, corroded, and field welded areas shall be cleaned and touched up with the same type of paint used in the shop painting.

3.2 BEARING PLATES

Bearing plates shall be provided with full bearing after the supporting members have been plumbed and properly positioned, but prior to placing superimposed loads. The area under the plate shall be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Bedding mortar and grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

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SECTION 05300A

STEEL DECKING
05/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Spec S335 (1989) Specification for Structural Steel Buildings - Allowable Stress Design, Plastic Design

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mnl (1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 108 (1999) Steel Bars, Carbon, Cold-Finished, Standard Quality

ASTM A 570/A 570M (1998) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality

ASTM A 611 (1997) Structural Steel (SS), Sheet, Carbon, Cold-Rolled

ASTM A 653/A 653M (2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 780 (2000) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings

ASTM A 792/A 792M (1999) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM C 423 (1999a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM E 795 (2000) Mounting Test Specimens During Sound Absorption Tests

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (2000) Structural Welding Code - Steel

AWS D1.3 (1998) Structural Welding Code - Sheet Steel

STEEL DECK INSTITUTE (SDI)

SDI Diaphragm Mnl (1991) Diaphragm Design Manual

SDI Pub No 29 (1995) Design Manual for Composite Decks, Form Decks, Roof Decks, and Cellular Metal Floor Deck with Electrical Distribution

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 20 (1991) Zinc-Rich Primers (Type I - "Inorganic" and Type II - "Organic")

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

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SD-02 Shop Drawings

Deck Units: ~~C, A/E~~
Accessories: ~~C, A/E~~
Attachments: ~~C, A/E~~
Holes and Openings: ~~C, A/E~~

Drawings shall include type, configuration, structural properties, location, and necessary details of deck units, accessories, and supporting members; size and location of holes to be cut and reinforcement to be provided; location and sequence of welded and fastener connections; and the manufacturer's erection instructions.

SD-03 Product Data

Deck Units: ~~C, A/E~~

Design computations for the structural properties of the deck units or SDI certification that the units are designed in accordance with SDI specifications.

Attachments

Prior to welding operations, copies of qualified procedures and lists of names and identification symbols of qualified welders and welding operators.

SD-04 Samples

Deck Units
Accessories

A 0.19 sq meter sample of the decking material to be used, along with a sample of each of the accessories used. A sample of

acoustical material to be used shall be included.

SD-07 Certificates

Deck Units
Attachments

Manufacturer's certificates attesting that the decking material meets the specified requirements. Manufacturer's certificate attesting that the operators are authorized to use the low-velocity piston tool.

1.3 DELIVERY, STORAGE, AND HANDLING

Deck units shall be delivered to the site in a dry and undamaged condition, stored off the ground with one end elevated, and stored under a weathertight covering permitting good air circulation. Finish of deck units shall be maintained at all times by using touch-up paint whenever necessary to prevent the formation of rust.

PART 2 PRODUCTS

2.1 DECK UNITS

Deck units shall conform to SDI Pub No 29. Panels of maximum possible lengths shall be used to minimize end laps. Deck units shall be fabricated in lengths to span 3 or more supports with flush, telescoped, or nested 50 mm laps at ends, and interlocking, or nested side laps, unless otherwise indicated. Deck with cross-sectional configuration differing from the units indicated may be used, provided that the properties of the proposed units, determined in accordance with AISI Cold-Formed Mnl, are equal to or greater than the properties of the units indicated and that the material will fit the space provided without requiring revisions to adjacent materials or systems.

2.1.1 Roof Deck

Steel deck used in conjunction with insulation and built-up roofing shall conform to ASTM A 792/A 792M, ASTM A 611 or ASTM A 792/A 792M. Roof deck units shall be fabricated of the steel design thickness required by the design drawings and shall be galvanized.

2.1.2 Sump Pans

Sump pans shall be provided for roof drains and shall be minimum 2 mm thick steel, flat or recessed type, as indicated. Sump pans shall be shaped to meet roof slope by the supplier or by a sheet metal specialist. Bearing flanges of sump pans shall overlap steel deck a minimum of 75 mm. Opening in bottom of pan shall be shaped, sized, and reinforced to receive roof drain.

2.2 TOUCH-UP PAINT

Touch-up paint for shop-painted units shall be of the same type used for the shop painting, and touch-up paint for zinc-coated units shall be an approved galvanizing repair paint with a high-zinc dust content. Welds shall be touched-up with paint conforming to SSPC Paint 20 in accordance with ASTM A 780. Finish of deck units and accessories shall be maintained by using touch-up paint whenever necessary to prevent the formation of rust.

2.3 ADJUSTING PLATES

Adjusting plates or segments of deck units shall be provided in locations too narrow to accommodate full-size units. As far as practical, the plates shall be the same thickness and configuration as the deck units.

2.4 CLOSURE PLATES

2.4.1 Closure Plates for Roof Deck

Voids above interior walls shall be closed with sheet metal where shown. Open deck cells at parapets, end walls, eaves, and openings through roofs shall be closed with sheet metal. Sheet metal shall be same thickness as deck units.

2.4.2 Closure Plates for Composite Deck

The concrete shall be supported and retained at each floor level. Provide edge closures at all edges of the slab of sufficient strength and stiffness to support the wet concrete. Metal closures shall be provided for all openings in composite steel deck 6 mm and over, including but not limited to:

2.4.2.1 Cover Plates to Close Panels

Cover plates to close panel edge and end conditions and where panels change direction or abut. Butt joints in composite steel deck may receive a tape joint cover.

2.4.2.2 Column Closures to Close Openings

Column closures to close openings between steel deck and structural steel columns.

2.4.2.3 Sheet Metal

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.5 ACCESSORIES

The manufacturer's standard accessories shall be furnished as necessary to complete the deck installation. Metal accessories shall be of the same material as the deck and have minimum design thickness as follows: saddles, 1.204 mm; welding washers, 1.519 mm; cant strip, 0.749 mm; other metal accessories, 0.909 mm; unless otherwise indicated. Accessories shall include but not be limited to saddles, welding washers, cant strips, butt cover plates, underlapping sleeves, and ridge and valley plates.

PART 3 EXECUTION

3.1 ERECTION

Erection of deck and accessories shall be in accordance with SDI Diaphragm Mnl and the approved detail drawings. Damaged deck and accessories including material which is permanently stained or contaminated, with burned holes or deformed shall not be installed. The deck units shall be

placed on secure supports, properly adjusted, and aligned at right angles to supports before being permanently secured in place. The deck shall not be filled with concrete, used for storage or as a working platform until the units have been secured in position. Loads shall be distributed by appropriate means to prevent damage during construction and to the completed assembly. The maximum uniform distributed storage load shall not exceed the design live load. There shall be no loads suspended directly from the roof steel deck.

3.2 ATTACHMENTS

All fasteners shall be installed in accordance with the manufacturer's recommended procedure, except as otherwise specified. The deck units shall be welded to supports as indicated on the design drawings and in accordance with requirements of SDI Pub No 29. All welding of steel deck shall be in accordance with AWS D1.3 using methods and electrodes as recommended by the manufacturer of the steel deck being used. Welds shall be made only by operators previously qualified by tests prescribed in AWS D1.3 to perform the type of work required. Welding washers shall not be used at the connections of the deck to supports. Welding washers shall not be used at sidelaps. Holes and similar defects will not be acceptable. Deck ends shall be lapped 50 mm. All partial or segments of deck units shall be attached to structural supports in accordance with Section 2.5 of SDI Diaphragm Mnl. Powder-actuated fasteners shall be driven with a low-velocity piston tool by an operator authorized by the manufacturer of the piston tool. Pneumatically driven fasteners shall be driven with a low-velocity fastening tool and shall comply with the manufacturer's recommendations.

3.3 HOLES AND OPENINGS

All holes and openings required shall be coordinated with the drawings, specifications, and other trades. Holes and openings shall be drilled or cut, reinforced and framed as indicated on the drawings or described in the specifications and as required for rigidity and load capacity. Holes and openings less than 150 mm across require no reinforcement. Holes and openings 150 to 300 mm across shall be reinforced by 1.204 mm thick steel sheet at least 300 mm wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 150 mm on center. Holes and openings larger than 300 mm shall be reinforced by steel angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Steel angles shall be installed perpendicular to the deck ribs and shall be fastened to the angles perpendicular to the steel joists. Openings must not interfere with seismic members such as chords and drag struts.

3.4 PREPARATION OF FIRE-PROOFED SURFACES

Deck surfaces, both composite and noncomposite, which are to receive sprayed-on fireproofing, shall be galvanized and shall be free of all grease, mill oil, paraffin, dirt, salt, and other contaminants which impair adhesion of the fireproofing. Any required cleaning shall be done prior to steel deck installation using a cleaning method that is compatible with the sprayed-on fireproofing.

-- End of Section --

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03/99

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SECTION 05400A

COLD-FORMED STEEL FRAMING

03/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. All the latest versions of the referenced publications shall be used.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Spec	Specification & Commentary for the Design of Cold-Formed Steel Structural Members (Part V of the Cold-Formed Steel Design Manual)
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 370	Mechanical Testing of Steel Products
ASTM A 653/A 653M	Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 633	Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C 955	Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
ASTM C 1007	Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories
ASTM E 329	Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3	Structural Welding Code - Sheet Steel
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SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J 78

Steel Self Drilling Tapping Screws

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Framing Components

- a. Framing drawings.
- b. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.
- c. Connection details showing fastener type, quantity, location, and other information to assure proper installation.
- d. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

SD-03 Product Data

Steel Studs; G A/E

SD-05 Design Data

Metal framing calculations; G A/E

SD-07 Certificates

Mill Certificates

Mill certificates or test reports from independent testing agency, qualified in accordance with ASTM E 329, showing that the steel sheet used in the manufacture of each cold-formed component complies with the minimum yield strengths and uncoated steel thickness specified. Test reports shall be based on the results of three coupon tests in accordance with ASTM A 370.

Welds; G A/E

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.3.

1.2.1 Drawing Requirements

Submit shop drawings showing layout, spacings, sizes, thicknesses, and types of cold-formed metal stud framing, fabrication, fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing,

bridging, splices, accessories, connection details, and attachments to other units of work. Shop drawing calculations shall be signed and sealed by a qualified professional engineer responsible for their preparations.

For cold-formed metal framing indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer responsible for their preparations.

1.2.2 Certificate Requirements

Mill certificates signed by manufacturers of cold-formed metal framing certifying that their products comply with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, and galvanized-coating thickness.

In lieu of mill certificates, submit test reports from a qualified independent testing agency evidencing compliance with requirements.

1.3 SYSTEM REQUIREMENTS

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Cold-formed framing shall consist of steel studs, top and bottom tracks, runners, horizontal bridging, and other cold-formed members and other accessories. All members and components made of sheet steel shall be hot-dip galvanized in accordance with ASTM A 653/A 653M with a minimum coating thickness of G-60 for non-masonry panel supports, and G 90 for Masonry Supports. Framing specified covering herein shall be used only in framing the exterior ~~masonry veneer steel~~ stud wall systems as indicated on the detail drawings. Metal framing for interior partitions are specified in Section 09260 GYPSUM BOARD ASSEMBLIES.

1.3.1 Steel Studs

Studs shall be furnished as shown in the contract documents. The minimum depth is 90 mm with a 35 mm flange depth. Other sizes used are 150 mm and 200 mm. See Structural drawings for design loads to determine required gauges and flange dimensions based on engineering calculations.

1.3.2 Runners, Tracks, Bridging and Accessories

Cold-formed steel sheet framing members, components, and accessories, other than the steel studs, shall conform to ASTM C 955 and be of steel conforming to ASTM A 653/A 653M, Grade 33, having a minimum yield strength of 230 MPa.

1.4 PERFORMANCE REQUIREMENTS

AISI "Specifications" calculate structural characteristics of cold-formed metal framing according to AISI Cold-Formed Spec and the following:

- a. Center for Cold-Formed Steel Structures (CFSS) Technical Bulletin, Vol 2, No. 1, February 1993 "AISI Specification Provisions for Screw Connections".

Structural performance: Engineer, fabricate, and erect cold-formed metal framing to withstand design loads within limits and under conditions required.

- a. Design Loads: As indicated on the structural drawings.

- b. Design framing systems to withstand design loads without deflections greater than the following:
 - 1. Exterior Masonry Wall supports: Lateral deflection of 1/600 of the wall height.
 - 2. Exterior Curtain Wall supports: Design the support framing to limit the deflection of the glazed curtain wall header normal to the plane of the wall to 1/360 of the clear span between vertical supports.
- c. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 48.89 degrees C.
- d. Design framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.

Design exterior nonload-bearing curtain wall framing to accommodate lateral deflection without regard to contribution of sheathing materials.

Engineering Responsibility: Engage a fabricator who assumes undivided responsibility for engineering cold-formed metal framing by employing a qualified professional engineer to prepare design calculations, shop drawings, and other structural data.

1.5 QUALITY ASSURANCE

1.5.1 Installer Qualifications

Engage an experienced Installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.5.2 Welding Standards

Comply with applicable provisions of AWS D.1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel".

- a. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5.3 Fire-Test-Response Characteristics

Where fire-resistance-rated assemblies are indicated, provide cold-formed metal framing identical to that tested as part of an assembly for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

Fire Resistance Ratings: As indicated by design designations listed in UL "Fire Resistance Directory", or by Warnock Hersey or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.5.4 Professional Engineer Qualifications

A professional engineer legally authorized to practice in the jurisdiction where project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of cold-formed metal framing similar to this Project in material, design, and extent and that have a record of successful in-service performance.

1.6 DELIVERY, HANDLING AND STORAGE

Materials shall be delivered and handled preventing bending or other damage, and avoiding contact with soil or other contaminating materials. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content, galvanizing repair paint whenever necessary to prevent the formation of rust.

PART 2 PRODUCTS

2.1 STEEL STUDS, TRACKS, BRACING, BRIDGING, AND ACCESSORIES

Framing components shall comply with ASTM C 955 and the following:

- a. Material shall be corrosion-resistant steel complying with ASTM A 653/A 653M, Grade 230 or higher, having a minimum yield of 230 MPa and a G 90 minimum zinc coating.
- b. Minimum uncoated steel thickness (design thickness times 0.95):
 - (1). Studs and Tracks: As required to resist wind or seismic loading.
 - (2). Bracing and bridging: Thickness as required to resist wind or seismic loading.
 - (3). Accessories: Standard thickness as provided by the manufacturer.
- c. Stud and Track web depth: As required to resist wind and seismic loading.
- d. Stud flange width: As required to resist wind and seismic loading.
- e. Stud effective section properties as required to resist wind or seismic loading.
- f. Refer to Structural for design and Architectural for placement.

2.2 MARKINGS

Studs and track shall have product markings on the web of the section. The markings shall be repeated throughout the length of the member at a maximum spacing of 1200 mm on center and shall be legible and easily read. The product marking shall include the following:

- a. Manufacturer's identification.
- b. Minimum delivered uncoated steel thickness.
- c. Protective coating designator.
- d. Minimum yield strength.

2.3 CONNECTIONS

Screws for steel-to-steel connections shall be self-drilling tapping in compliance with SAE J 78 of the type, size, and location as shown on the drawings. Electroplated screws shall have a Type II coating in accordance with ASTM B 633. Screws, bolts, and anchors shall be hot-dipped galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate. Screws bolts, and anchors shall be hot dipped galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate.

PART 3 EXECUTION

3.1 Delivery, Handling and Storage

a. Materials shall be delivered and handled in a manner to avoid bending or other damage and to avoid contact with the soil or other contaminating materials.

b. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content galvanizing repair paint whenever necessary to prevent the formation of rust.

3.2 CONNECTIONS

3.2.1 Welds

All welding shall be performed in accordance with AWS D1.3, as modified by AISI Cold-Formed Specification. All welders, welding operations, and welding procedures shall be qualified according to AWS D1.3. All welds shall be cleaned and coated with rust inhibitive galvanizing paint.

3.2.2 Screws

Screws shall be of the type, size, and location as required to resist wind or seismic loading. Screw penetration through joined materials shall not be less than three exposed threads. Minimum spacings and edge distances for screws shall be as specified in AISI Cold-Formed Spec. Screws covered by sheathing materials shall have low profile heads.

3.2.3 Anchors

Anchors shall be of the type, size, and location as required to resist wind or seismic loading.

3.3 INSTALLATION

3.3.1 General Requirements

- a. Prefabricated frames shall be square, with components attached to prevent racking during fabrication, transportation, and lifting. Design and construction of frames shall include provisions for lifting.
- b. Cutting of steel framing shall be by saw, shear, or plasma cutting equipment. Oxyacetylene torch cutting is not permitted.
- c. Temporary bracing shall be provided and remain in place until work is permanently stabilized.

- d. Abutting lengths of track shall be butt-welded, spliced, or each length securely anchored to a common structural element. Track shall be securely anchored to the supporting structure as shown on the drawings.
- e. Splicing of framing components, other than track and tension members, is not permitted.
- f. Wire tying of framing members is not permitted.

3.3.2 Non-Load Bearing Walls

- a. Studs shall be spaced as shown on the drawings.
- b. Studs shall be plumbed, aligned, and secured to the continuous runner tracks at each end, unless the stud end terminates at a deflection track.
- c. Tracks shall be securely anchored to the supporting structure as shown on the drawings.
- d. Bridging spaced as required to resist wind or seismic loading shall be installed prior to the installation of facing materials.
- e. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all openings that are larger than the stud spacing in a wall.
- f. At wall openings for doors, windows and other similar features, the framing system shall provide for the installation and anchorage of the required subframes or finish frames. Steel frames shall be securely attached through built-in anchors to the nearest stud on each side of the opening with self-drilling screws. Double studs shall be provided at both jambs of all door openings.
- g. Installation of sheathing, wallboards, or any other collateral material shall be performed in accordance with the product manufacturer's specifications.
- h. Components (Deflection Track and/or Slide Clips) shall be provided at locations shown on the drawings to accommodate potential movements of Primary Frames. Construction shall accommodate construction tolerances to clearances at openings to provide movement of framing members without damage or overstressing sheathing, connection failure or other detrimental effects when subject to a maximum ambient temperature change (range) or 48.9 degrees C.

3.4 TOLERANCES

Vertical alignment (plumbness) of studs shall be within 1/960th of the span. Horizontal alignment (levelness) of walls shall be within 1/960th of their respective lengths. Spacing of studs shall not be more than plus 3 mm from the designed spacing providing the the cumulative error does not exceed the requirements of the finishing material.

-- End of Section --

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09/01

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SECTION 05500

MISCELLANEOUS METAL

09/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA 45 (1980) Aluminum Finishes

AA 46 (1978) Anodized Architectural Aluminum

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M180 (1995) Corrugated Sheet Steel Beams for Highway Guardrail

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC S303 (1992) Steel Buildings and Bridges

AISC S335 (1989) Structural Steel Buildings Allowable Stress Design and Plastic Design

AISC S342L (1993) Load and Resistance Factor Design Specification for Structural Steel Buildings

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.3 (1995) Power-Actuated Fastening Systems

ANSI B18.2.1 (1996) Square and Hex Bolts and Screws Inch Series

ANSI B18.6.2 (1972; R 1993) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws

ANSI B18.6.3 (1972; R 1997) Machine Screws and Machine Screw Nuts

ASME INTERNATIONAL (ASME)

ASME/ANSI B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)
ASME/ANSI B18.21.1	(1994) Lock Washers (Inch Series)
ASME/ANSI B18.21.2M	(1994) Lock Washers (Metric)
ASME/ANSI B18.22M	(1981; R 1990) Metric Plain Washers
ASME/ANSI B18.22.1	(1965; R 1998) Plain Washers

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1996) Carbon Structural Steel
ASTM A 47M	(1990; R 1996) Ferritic Malleable Iron Castings (Metric)
ASTM A 47	(1990; R 1995) Ferritic Malleable Iron Castings
ASTM A 48M	(1994; Rev. A) Gray Iron Castings (Metric)
ASTM A 48	(1994; Rev. A) Gray Iron Castings
ASTM A 53	(1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 123/A 123M	(1997; Rev. A) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(1995) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 500	(1996) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 569/A 569M	(1997) Commercial Steel (CS) Sheet and Strip, Carbon (0.15 Maximum Percent), Hot-Rolled
ASTM A 653/A 653M	(1997) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 687	(1993) High-Strength Nonheaded Steel Bolts and Studs
ASTM A 780	(1993; Rev. A) Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized

Coatings

ASTM A 786/A 786M	(1993) Rolled Steel Floor Plates
ASTM B 26/B 26M	(1997) Aluminum-Alloy Sand Castings
ASTM B 108	(1997) Aluminum-Alloy Permanent Mold Castings
ASTM B 209M	(1995) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221M	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 429	(1995) Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM D 1187	(1997) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM E 488	(1996) Strength of Anchors in Concrete and Masonry Elements

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1998) Structural Welding Code - Steel
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.27	Fixed Ladders
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U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-P-664	(Rev. D) Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC-Compliant
FS RR-G-1602	(Rev. D) Grating, Metal, Other Than Bar Type (Floor, Except for Naval Vessels)

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM BG	(1993) Metal Bar Grating Manual
NAAMM PR	(1995) Pipe Railing Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (1997) Life Safety Code

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3 (1995) Power Tool Cleaning

SSPC SP 6 (1994) Commercial Blast Cleaning

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

Fabrication drawings of structural steel door frames

Access doors and panels; installation drawings

Cover plates and frames; installation drawings

Expansion joint covers, installation drawings

Floor gratings and frames, installation drawings

Fabrication drawings of handrails; installation drawings

Fabrication drawings of ladders; installation drawings

Fabrication drawings of ship's ladder (with or without guards);
installation drawings

Angles and plates; installation drawings

Roof hatch

Utility Support Framing

Wire Mesh Partitions; installation drawings

Stainless steel cable and shelf supports

Corner guards; installation drawings

SD-03 Product Data

Access doors and panels

Cover plates and frames

Control-joint covers

Expansion joint covers

Floor gratings and frames

Roof hatch

Wire Mesh Partitions

Stainless steel cable and shelf supports

Corner guards

SD-04 Samples

Expansion joint covers

Control-joint covers

Stainless steel cable and shelf supports

Corner guards

Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

SD-05 Design Data

Calculations for the stainless steel cable and shelf supports; G
A/E

SD-10 Operation and Maintenance Data

Expansion joint covers

Control joint covers

1.3 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1. Use procedures, materials, and equipment of the type required for the work.

1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Structural Carbon Steel

ASTM A 36/A 36M.

2.1.2 Structural Tubing

ASTM A 500.

2.1.3 Steel Pipe

ASTM A 53, Type E or S, Grade B.

2.1.4 Fittings for Steel Pipe

Standard malleable iron fittings ASTM A 47M.

2.1.5 Gratings

a. Gray cast iron ASTM A 48M, Class 40.

b. Metal plank grating, non-slip requirement, FS RR-G-1602 aluminum ASTM B 209M , 6061-T6; steel ASTM A 653/A 653M, Z275.

c. Metal bar type grating NAAMM BG.

2.1.6 Floor Plates, Patterned

Floor plate ASTM A 786/A 786M. Steel plate shall not be less than 1.9 mm.

2.1.7 Anchor Bolts

ASTM A 307. Where exposed, shall be of the same material, color, and finish as the metal to which applied.

2.1.7.1 Expansion Anchors, Sleeve Anchors, Adhesive Anchors

Provide 10 mm to 13 mm diameter expansion anchors, sleeve anchors, adhesive anchors. Minimum concrete and masonry embedment shall be as indicated on the drawings.

2.1.7.2 Lag Screws and Bolts

ANSI B18.2.1, type and grade best suited for the purpose.

2.1.7.3 Toggle Bolts

ANSI B18.2.1.

2.1.7.4 Bolts, Nuts, Studs and Rivets

ASME/ANSI B18.2.2 and ASTM A 687 or ASTM A 307.

2.1.7.5 Powder Driven Fasteners

Follow safety provisions of ANSI A10.3.

2.1.7.6 Screws

ANSI B18.2.1, ANSI B18.6.2, and ANSI B18.6.3.

2.1.7.7 Washers

Provide plain washers to conform to ASME/ANSI B18.22M. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers to conform to ASME/ANSI B18.21.2M.

2.1.8 Aluminum Alloy Products

Conform to ASTM B 209M for sheet plate, ASTM B 221M for extrusions and ASTM B 26/B 26M or ASTM B 108 for castings, as applicable. Provide aluminum extrusions at least 3 mm thick and aluminum plate or sheet at least 1.3 mm thick.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A 123/A 123M, ASTM A 153/A 153M or ASTM A 653/A 653M, Z275, as applicable.

2.2.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A 780 or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.2.4 Shop Cleaning and Painting

2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with SSPC SP 6. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with SSPC SP 3 in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete shall be free of dirt and grease. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints, but coat with rust preventative

applied in the shop.

2.2.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions. On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 0.03 mm. Tint additional prime coat with a small amount of tinting pigment.

2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.2.6 Aluminum Surfaces

2.2.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2.2.6.2 Unexposed Sheet, Plate, and Extrusions

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA 45, or AA 46.

2.3 ACCESS DOORS AND PANELS

Provide flush type access doors and panels. Fabricate frames for access doors of steel not lighter than 1.9 mm with welded joints and anchorage for securing into construction. Provide access doors with a minimum of 350 by 500 mm and of not lighter than 1.9 mm steel, with stiffened edges and welded attachments. Provide access doors hinged to frame and with a flush-face, turn-screw-operated latch. Provide exposed metal surfaces with a shop applied prime coat.

2.4 CONTROL-JOINT COVERS

Provide control-joint covers to be located on wall surfaces of concrete, masonry and tile work. Provide protective coating on the surface in contact with concrete, masonry or tile.

2.5 CORNER GUARDS AND SHIELDS

Jams and sills of openings and edges of platforms shall be steel shapes and plates anchored in masonry or concrete with welded steel straps or end-weld stud anchors. Corner guards for use with glazed or ceramic tile finish on walls shall be formed of 1.6 mm thick stainless steel with polished or satin finish, shall extend 1.5 m above the top of cove base or to the top of the wainscot, whichever is less, and shall be securely anchored to the supporting wall. Corner guards on exterior shall be galvanized.

2.6 COVER PLATES AND FRAMES

Fabricate cover plates of 6 mm thick rolled steel weighing not more than 45 kg per plate with a selected raised pattern nonslip top surface. Plate shall be galvanized. Reinforce to sustain a live load as indicated on the drawings. Frames shall be structural steel shapes and plates, with bent steel bars or headed anchors welded to frame for anchoring to concrete and securely fastened to the structure as indicated. Miter and weld all corners. Butt joint straight runs. Allow for expansion on straight runs over 4500 mm. Provide holes for lifting tools. Provide flush drop handles for removal formed from 6 mm round stock where indicated. Provide holes and openings with 13 mm clearance for pipes and equipment. Remove sharp edges and burrs from cover plates and exposed edges of frames. Weld all connections and grind top surface smooth. Weld bar stops every six inches. Provide 3 mm clearance at edges and between cover plates.

2.7 EXPANSION JOINT COVERS

Provide expansion joint covers constructed of extruded aluminum with anodized satin aluminum finish for walls and ceilings and with standard mill finish for floor covers and exterior covers. Furnish plates, backup angles, expansion filler strip and anchors as indicated. Expansion joint system shall provide 25 mm movement.

2.8 FLOOR GRATINGS (Non-corrosive locations)

Design steel grating in accordance with NAAMM BG for bar type grating or manufacturer's charts for plank grating. Galvanize steel floor gratings.

- a. NAAMM BG, band edges of grating with bars of the same size as the bearing bars. Weld banding in accordance with the manufacturer's standard for trim unless otherwise indicated. Design tops of bearing bars, cross or intermediate bars to be in the same plane and match grating finish.
- b. Attach grating as per manufacturer's attachment system.
- c. Slip resistance requirements FS RR-G-1602.

2.9 FLOOR GRATINGS (Corrosive locations)

Grating shall be constructed of structural load and cross bar components, assembled and bonded into a one piece panel, similar to CorGrate as manufactured by IKG Industries or equal. Grating shall be CorGrate Pultruded HI Series, 38 mm x 38 mm capable of spanning 1800 mm. Resin shall be yellow vinyl ester type, fire retardant with a flame spread rating of 25 or less. Slip resistant top surface of grating shall be standard grit.

2.10 GUARD POSTS (BOLLARDS)

Provide galvanized extra strong weight steel pipe as specified in ASTM A 53. Anchor posts in concrete as indicated and fill solidly with concrete with

minimum compressive strength of 17 MPa.

2.11 HANDRAILS

Design handrails to resist a concentrated load of 890 N in any direction at any point of the top of the rail or 290 N/m applied horizontally to top of the rail, whichever is more severe. NAAMM PR, provide the same size rail and post. Provide pipe collars of the same material and finish as the handrail and posts.

2.11.1 Steel Handrails, Including Carbon Steel Inserts

Provide steel handrails, including inserts in concrete, steel pipe conforming to ASTM A 53 or structural tubing conforming to ASTM A 500, Grade A or B of equivalent strength. Provide steel railings of 40 mm nominal size. Railings to be hot-dip galvanized and shop painted.

- a. Fabrication: Joint posts, rail, and corners by one of the following methods:

- (1) Flush-type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 10 mm hexagonal-recessed-head setscrews.

- (2) Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Butt railing splices and reinforce them by a tight fitting interior sleeve not less than 150 mm long.

- (3) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

- b. Provide removable sections as indicated.

2.12 LADDERS

Fabricate vertical ladders conforming to Section 7 of 29 CFR 1910.27. Use 65 by 10 mm steel flats for stringers and 20 mm diameter steel rods for rungs. Rungs to be not less than 400 mm wide, spaced one foot apart, plug welded or shouldered and headed into stringers. Install ladders so that the distance from the rungs to the finished wall surface will not be less than 175 mm. Provide heavy clip angles riveted or bolted to the stringer and drilled for not less than two 12 mm diameter expansion bolts as indicated. Provide intermediate clip angles not over 1200 mm on centers.

Provide retractable extension pole permanently mounted to top two ladder rungs at roof hatches. Construct extension pole of heavy duty steel pipe, designed to slide freely up and down inside a top and bottom mounted bracket, and automatically lock in place when fully extended. Upward and downward movement shall be controlled by a stainless steel spring balancing mechanism. Finish brackets and pole to match ladder. Pole shall extend a minimum of 1050 mm above the surface of the roof.

2.12.1 Ladder Cages

Conform to 29 CFR 1910.27. Fabricate 50 by 6 mm horizontal bands and 40 by 5 mm vertical bars. Provide attachments for fastening bands to the side rails of ladders or directly to the structure. Provide and fasten vertical bars on the inside of the horizontal bands. Extend cages not less than 690 mm or more than 710 mm from the centerline of the rungs, excluding the flare at the bottom of the cage, and not less than 690 mm in width. Clear the inside of the cage of projections.

2.12.2 Ship's Ladder

Fabricate stringers and framing of steel plate or shapes. Bolt, rivet or weld connections and anchor to supporting construction. Provide treads with non-slip surface as specified for safety treads. Design assembly, including tread connections and methods of attachment, to support a live load of 1300 N per tread. Provide railings as specified for metal handrails.

2.13 MISCELLANEOUS PLATES AND SHAPES

Provide for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings and frames. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as indicated and as required to support wall loads over openings. Provide with connections and fasteners. Construct to have at least 200 mm bearing on masonry at each end.

Provide angles and plates, ASTM A 36/A 36M, for embedment as indicated. Galvanize embedded items exposed to the elements according to ASTM A 123/A 123M.

2.14 SAFETY CHAINS

Construct safety chains of galvanized steel, straight link type, 5 mm diameter, with at least twelve links per 300 mm, and with snap hooks on each end. Provide snap hooks of boat type. Provide galvanized 10 mm bolt with 20 mm eye diameter for attachment of chain, anchored as indicated. Supply two chains, 100 mm longer than the anchorage spacing, for each guarded area. Locate safety chain where indicated. Mount the top chain 1050 mm above the floor and mount the lower chain 600 mm above the floor.

2.15 SAFETY NOSINGS FOR CONCRETE TREADS

Provide safety nosings of cast aluminum or cast iron with cross-hatched abrasive-surfaces, or extruded aluminum with abrasive inserts. Nosing to be at least 100 mm wide and 6 mm thick and terminating at not more than 150 mm from the ends of treads for stairs and as indicated for platforms and landings. Provide safety nosings with anchors embedded in the concrete and with tops flush with the top of the traffic surface.

2.16 STRUCTURAL STEEL DOOR FRAMES

- a. Provide frames as indicated. If not otherwise shown, construct frames of structural shapes, or shape and plate composite, to form

a full depth channel shape with at least 40 mmoutstanding legs. For single swing doors, provide continuous 16 by 40 mm bar stock stops at head and jambs.

- b. Where track, guides, hoods, hangers, operators, and other such accessories are required, provide support as indicated.
- c. Provide jamb anchors near top, bottom, and at not more than 600 mm intervals. Provide the bottom of each jamb member with a clip angle welded in place with two 12 mmdiameter floor bolts for adjustment.

Provide frames of rolled shapes as indicated. Miter and weld heads to jambs, or have riveted clip angle connections concealed in the finished work. Provide frames for swinging doors with 16 by 40 mm solid bar stops secured to the frame by welding or by 6 mm diameter countersunk machine screws spaced not more than 300 mm on centers. Stiffen head openings greater than 900 mm sufficient to limit deflection to not more than 2 mm. Secure frames to masonry with zinc-coated metal anchors spaced not more than 750 mm on centers. Where necessary to engage the threads of machine screws for fastening hardware, back frames on inside faces with steel plates of suitable thickness; tap frames and reinforcing plates as necessary for the installation of hardware and other work. Countersink rivets and screw heads where exposed in the finished work. Grind welds smooth.

2.17 WIRE MESH PARTITIONS

Partitions shall be constructed of metal fabric attached to structural steel framing members. Fabric shall be 10 gauge steel wire welded into 50 mm square mesh, secured to channel frame by welding. Framing members shall be channels 38 by 38 mm minimum size. Channel frames shall be mortised and tenoned at intersections. Steel frames, posts, and intermediate members shall be of the sizes and shapes indicated. Cast-iron floor shoes and caps shall have setscrew adjustment. Doors and grilles shall be provided as indicated, complete with hardware and accessories including sliding mechanisms, locks, guard plates, sill shelves and brackets, and fixed pin butts. Doors and grilles shall have cover plates as indicated. A continuous rubber bumper shall be provided at bottom of grille frame. Locks shall be bronze, cylinder, mortise type. Keying shall be coordinated with Section 08710 DOOR HARDWARE. Ferrous metal portions of partitions and accessories shall be factory painted finish.

2.18 UTILITY SUPPORT FRAMING

Channel Framing: Cold-formed metal channels with flange edges returned toward web.

Width of Channels: Sizes are indicated on the drawings.

Depth of Channels: Sizes are indicated on the drawings.

Metal and Thickness: Uncoated steel complying with ASTM A 570, Grade 33; 2.7-mm minimum thickness.

Finish: Rust-inhibitive, baked-on, acrylic enamel.

2.19 STAINLESS STEEL CABLE AND SHELF SUPPORT SYSTEM

System is based on products by Seco South, Inc., System 2000 tension assemblies. Provide 3 mm stainless steel wire and shelf cone. Shelf cone shall be two piece fitting that clamps on to the wire. Top part of cone shall have a set screw to provide a holding force of approximately 36 kg. The cone shall be designed for a 10 mm glass shelf. Submit design calculations to verify design requirements.

2.20 STEEL SECURITY MESH

Number 8 gauge high carbon maganese steel with a grid of not more than 50 mm center to center. Attach to the structure so that destruction of the existing structure is required to remove them.

PART 3 EXECUTION

3.1 INSTALLATION

Install items at locations indicated, according to manufacturer's instructions. Items listed below require additional procedures.

3.2 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.3 BUILT-IN WORK

Form for anchorage metal work built-in with concrete or masonry, or provide with suitable anchoring devices as indicated or as required. Furnish metal work in ample time for securing in place as the work progresses.

3.4 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.5 FINISHES

3.5.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to FS TT-P-664 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D 1187, asphalt-base

emulsion.

3.5.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, shall be free of rust, grease, dirt and other foreign matter.

3.5.3 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than -15 degrees C above the dew point of the surrounding air, or when surface temperature is below 7 degrees C or over 35 degrees C, unless approved by the Contracting Officer.

3.6 ACCESS PANELS

Install a removable access panel not less than 300 by 300 mm directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would otherwise not be accessible.

3.7 CONTROL-JOINT COVERS

Provide covers over control-joints and fasten on one side only with fasteners spaced to give positive contact with wall surfaces on both sides of joint throughout the entire length of cover.

3.8 COVER PLATES AND FRAMES

Install the tops of cover plates and frames flush with floor.

3.9 HANDRAILS

3.9.1 Steel Handrail

Install in pipe sleeves embedded in concrete and filled with non-shrink grout or quick setting anchoring cement with anchorage covered with standard pipe collar pinned to post. by means of pipe sleeves secured to wood with screws, masonry with expansion shields, bolts or toggle bolts, or by means of base plates bolted to stringers or structural steel frame work.

Secure rail ends by steel pipe flanges anchored by expansion shields and bolts, through-bolted to a back plate or by 6 mm lag bolts to studs or solid backing.

3.10 LADDERS

Secure to the adjacent construction with the clip angles attached to the stringer. Secure to masonry or concrete with not less than two 12 mm diameter expansion bolts. Install intermediate clip angles not over 1200 mm on center. Install brackets as required for securing of ladders welded or bolted to structural steel or built into the masonry or concrete. In no case shall ends of ladders rest upon finished roof or floor.

3.11 ROOF HATCH

Shall be of zinc-coated steel sheets not less than 1.9 mm, with 75 mm beaded flange, welded and ground at corner. Provide a minimum clear opening of 760 by 940 mm. Construction and accessories shall be as follows:

- a. Insulate cover and curb with 25 mm thick rigid fiberboard insulation covered and protected by zinc-coated steel liner not less than 0.45 mm. Curb shall be 300 mm high, formed with 75 mm mounting flange with holes provided for securing to the roof deck. Equip the curb with an integral metal cap flashing of the same gage and metal as the curb, full welded and ground at corners for weather tightness.
- b. Provide hatch completely assembled with pintle hinges, compression spring operators enclosed in telescopic tubes, positive snap latch with turn handles on inside and outside, and neoprene draft seal. Provide fasteners for padlocking on the inside. Equip the cover with an automatic hold-open arm complete with grip handle to permit one-hand release. Cover action shall be smooth through its entire range with an operating pressure of approximately 130 N.

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SECTION 06114

WOOD BLOCKING AND CURBING

07/01

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WOOD BLOCKING AND CURBING
07/01

1.1 REFERENCES

AMERICAN PLYWOOD ASSOCIATION

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA P5 (2000) Standards for Waterborne Preservatives

NBS PS 1 Construction and Industrial Plywood

NIST PS 20 American Softwood Lumber Standard

1.2 SUBMITTALS

SECTION 06114 Page 2 (Revised by Amendment No. 0008)

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SD-01 Preconstruction Submittals

Schedule

Provide a schedule of all blocking to be used in the building.

SD-03 Product Data

Wood Treatment Data; G ~~REA/E~~

Including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials.

For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.

For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.

For fire-retardant-treated wood products, include certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holding capacities of treated materials.

SD-07 Certificates

Warranty of chemical treatment manufacturer for each type of treatment.

1.3 QUALITY ASSURANCE

1.3.1 Lumber

Comply with NIST PS 20 and approved grading rules and inspection agencies. Lumber shall be treated in accordance with AWPA C2 with waterborne preservatives listed in AWPA C9.

1.3.2 Grade Stamps for Concealed Lumber

Each piece of lumber, applied by inspection agency and showing compliance with each specified requirement.

1.3.3 Construction Panels

Comply with NBS PS 1 where veneer plywood is specified; comply with APA PRP-108 where APA rated panels are specified; bearing APA trademark showing compliance with each specified requirement.

1.3.4 Use and marking of Fire-Retardant Treated Wood

Each piece of lumber or plywood, applied by inspection agency, and showing compliance with specified standards. Only fire retardant treated wood meeting non-combustible standards will be acceptable for use in the project. Plywood shall be treated in accordance with AWPA C9 with

waterborne preservatives listed in AWP A P5.

1.4 DELIVERY, STORAGE AND HANDLING

Protect wood products against moisture and dimensional changes. Support stacks at several uniformly spaced points to prevent deformation. Store stacks raised above ground. Cover to protect from rain and snow. Select and arrange cover to allow air circulation under and all around stacks to prevent condensation. Maintain and restore displaced coverings. Remove from the site any wood products that have been subjected to moisture or that do not comply with the specified moisture requirements.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Lumber Grading Rules

NFPA, SPIB, WCLIB, WWP A.

2.1.2 Miscellaneous Framing

Stress Group D Southern Pine species, 19 percent maximum moisture content, pressure preservative treat.

2.1.3 Plywood

APA Structural I, Grade C-D with exterior glue; Exposure Durability 1; sanded, pressure preservative treat.

2.2 ACCESSORIES

2.2.1 Fasteners

Hot-dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.

2.2.2 Anchors

Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

PART 3 EXECUTION

3.1 FRAMING

- a. Set members level and plumb, in correct position.
- b. Place horizontal members flat, crown side up.
- c. Space framing and furring 406.4 mm on center.

3.2 PLYWOOD BLOCKING AND BACKBOARDS

- a. Secure sheathing to framing members with ends over firm bearing and staggered.
- b. Install telephone and electrical panel boards with plywood

sheathing material where required. Oversize the panel by 304.8 mm on all sides.

3.3 SITE APPLIED WOOD TREATMENT

- a. Apply preservative treatment in accordance with AWP4 M4.
- b. Brush apply one coat of preservative treatment on wood in contact with cementitious materials, roofing and related metal flashings. Treat site-sawn cuts.
- c. Allow preservative to dry prior to erecting members.

3.4 SCHEDULES

3.4.1 Roof Blocking

S/P/F/ species, 19 percent maximum moisture content, pressure preservative treatment.

3.4.2 Telephone and Electrical Panel Boards

19.05 mm thick, square edges, site brush applied preservative treated.

3.4.3 Laboratory Casework and millwork

3.4.4 Toilet Accessories

3.4.5 Other Miscellaneous Blocking

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SECTION 06116

EXTERIOR GLASS REINFORCED GYPSUM SHEATHING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. All the latest versions of the referenced publications shall be used.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM 653/A 653M	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron alloy-Coated (Galvannealed) by the Hot-dip Process
ASTM C 954	Specification for Steel Drill Screws for Application of Gypsum Panel Products
ASTM C 1177	Standard Specification for Glass Mat Gypsum Substrate for Use a Sheathing
ASTM D 226	Specification for Asphalt Saturated Organic Felt
ASTM E 84	Standard Test Method for Surface Burning Characteristics
ASTM E 136	Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wall sheathing board

Roof deck board

Submit manufacturer's specifications, installation instructions,

and general recommendations for each major product required.
Include data substantiating that products to be furnished comply
with requirements of the contract documents.

SD-07 Certificates

Wall sheathing board

Roof deck board

Certification that products meet specified requirements.

1.3 WARRANTY

Provide sheathing manufacturer's standard warranty covering sheathing and
deck board materials for five years from date of installation.

Provide sheathing manufacturer's standard warranty covering
in-place exposure damage to sheathing and deck board for six
months from date of installation.

1.4 DELIVERY, STORAGE, AND HANDLING

- a. Keep materials dry at all times. Protect against exposure to
weather and against contact with damp or wet surfaces.
- b. Protect materials from excessive moisture in shipment, storage,
and handling. Deliver materials in manufacturer's unopened
packages, and store in dry place with adequate air circulation.
- c. Stack products of this section carefully to provide air
circulation within stacks.

PART 2 PRODUCTS

2.1 EXTERIOR GYPSUM SHEATHING BOARD

Fiberglass-Faced Gypsum Sheathing to comply with ASTM C 1177.

- a. Core: Water-resistant silicone-treated gypsum core.
- b. Facers: Alkali-resistant fiberglass mat front and back.
- c. Thickness: 15.875 mm.
- d. Surface burning hazard: Comply with ASTM E 84; 0 flame spread, 0
smoke developed.
- e. Noncombustible when tested in accordance with ASTM E 136.

2.2 GYPSUM DECKING BOARD

Non-Structural, Glass Mat Embedded, water-resistant gypsum core panels to
comply with ASTM E 136 and ASTM C 1177.

- a. Surface treatment: Non-asphaltic, integral pre-primed surface
treatment
- b. Core: Water-resistant gypsum core.

- c. Fire Resistance: Flame spread 0; Smoke developed 0.
- d. Thickness: 15.875 mm.

2.3 FASTENERS

2.3.1 Fasteners for Metal Framing

To comply with ASTM C 954.

- a. Over 12 to 22 gage steel framing: Type S-12 fine thread, rust resistant, drill point dry wall screws.
- b. Over light gage metal framing or furring: Type S fine thread, rust resistant, sharp point dry wall screws.
- c. Length: 31.75 mm minimum #6 for 15.875 mm thick sheathing.

PART 3 EXECUTION

3.1 EXAMINATION

Inspect substrates and conditions under which the work of this section will be performed, and verify that installation properly may commence. Do not proceed with the work until unsatisfactory conditions have been resolved fully.

3.2 INSTALLATION

Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

3.2.1 Sheathing Board

- a. Install sheathing over framing. Butt joints together. Layout work and use appropriate length material to avoid end joints. Joints shall occur over framing members. Stagger end points between adjacent panels.
 - 1. Fit sheathing snug around corners, projections, and other openings.
 - 2. Comply with installation details in accordance with manufacturer's instructions.
 - 3. Drive fasteners tight against and flush with sheathing surface. Do not countersink fasteners.
 - 4. Locate fasteners not closer than 9.525 mm from edge and ends of panels.
 - 5. Space fasteners at not more than 203.2 mm on center at perimeter and field, unless closer spacing is indicated on the drawings.
- b. Coordinate sheathing installation and spacing of joints with installation of joint trim as indicated on the drawings.

- c. Ensure that control and expansion joints and vents align with 2 independent framing members.
- d. Interrupt sheathing for control and expansion joints and vents.

3.2.2 Sealing Sheathing Joints

Seal joints and penetrations according to sheathing manufacturer's written recommendations and as follows:

- a. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed sealant in entire face of tape. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.2.3 Roof Deck Board

Install deck board with ends and edges butted tightly. Use fasteners in accordance with FM requirements and roof membrane manufacturer's written recommendations.

3.3 CLEANING

- a. During progress of the work, remove from project site all discarded materials, rubbish, and debris resulting from the work.
- b. Upon completion, clean all surfaces which have become soiled or coated as a result of work of this section, using proper methods which will not scratch or otherwise damage finished surfaces.
- c. For cleaning, use only products and techniques acceptable to manufacturer of products being cleaned.

3.4 PROTECTION

Where sheathing barrier is damaged before installation of permanent cladding, repair in accordance with manufacturer's recommendations and to the satisfaction of the Architect.

-- End of Section --

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DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07110A

BITUMINOUS DAMPPROOFING

09/98

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SECTION 07110A

BITUMINOUS DAMPPROOFING
09/98

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. All the latest versions of the referenced publications shall be used.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 41	Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 4586	Standard Specification for Asphalt Roof Coatings; Asbestos-Free
ASTM D 4479	Asphalt Roof Coatings - Asbestos Free

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-07 Certificates

Materials: ~~C-A/E~~

Certificates attesting that the materials meet the requirements specified.

1.3 QUALIFICATIONS

Work shall be performed by skilled laborers thoroughly experienced in the type of bituminous dampproofing work specified to meet the requirements of the contract.

1.4 DELIVERY, STORAGE AND HANDLING

Dampproofing materials shall be delivered to the project site in the original sealed containers bearing the name of manufacturer, contents and brand name, and stored in a weathertight enclosure to prevent moisture damage and absorption. Dampproofing materials shall be protected from freezing. Asphalt shall be stored off the ground on pallets, and covered on top and all sides with breathable-type canvas tarpaulins. Plastic sheets cause condensation buildup; and therefore, shall not be used to cover dampproofing materials. Care shall be taken during storage to avoid

separation or settlement of the emulsion components. Damaged or deteriorated materials shall be removed from the project site.

1.5 SITE CONDITIONS

Install dampproofing only when site weather conditions are acceptable per manufacturer's recommendations. Provide sufficient ventilation during application and curing of dampproofing to prevent buildup of toxic or flammable fumes.

PART 2 PRODUCTS

2.1 SOLVENT-BASED ASPHALT DAMPPROOFING

2.1.1 Asphaltic Primer

Primer for cold-applied solvent-based asphalt dampproofing shall conform to ASTM D 41, asbestos-free, non-fibrated, manufactured with highly ductile soft asphalts and selected hydrocarbons.

2.1.2 Fibrated Asphalt

Fibrated solvent-based asphalt dampproofing shall be cold-applied type conforming to ASTM D 4479 Type I, asbestos-free, manufactured with selected asphalts, stabilizers, mineral spirits and fibrated with mineral fibers. Solvent-based asphalt shall contain 72 percent solids by weight, 65 percent solids by volume.

2.2 INSTALLATION ACCESSORIES

Reinforcing fabric shall be woven or nonwoven glass fiber, treated with organic binders and coated for compatibility with dampproofing bitumen. Detailing mastic shall be asphalt-based plastic roof cement, trowel consistency, meeting the requirements of ASTM D 4586.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces scheduled for bituminous dampproofing shall be prepared in accordance with dampproofing manufacturer's recommendations. Surface preparation shall be approved prior to dampproofing application. Fill cracks, holes, depressions, and irregularities with latex patching mortar or detailing mastic as recommended by membrane manufacturer. Form fillets (cants) at inside corners and around projecting elements using latex patching mortar or detailing mastic.

3.1.1 Protection of Surrounding Areas

Before starting the dampproofing work, the surrounding areas and surfaces shall be protected from spillage and migration of asphalt onto other work. Drains and conductors shall be protected from clogging with asphalt.

3.1.2 Masonry Surfaces

Surfaces shall be free of oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Mortar joints shall be flush and free of extraneous mortar and chipped or broken masonry.

3.1.3 Concrete Surfaces

Surfaces shall be properly cured, free of form release agents, oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Form ties shall be cut flush with surface. Sharp protrusions and form match lines shall be removed. Holes, voids, spalled areas and cracks which can damage the dampproofing materials and impair performance shall be repaired.

Rough surfaces shall be parged with a well-adhering coat of cement mortar.

3.1.4 Metal Surfaces

Metal surfaces shall be dry and be free of rust, scale, loose paint, oil, grease, dirt, frost and debris.

3.2 APPLICATION OF BITUMINOUS DAMPPROOFING

3.2.1 Solvent-Based Asphalt

Solvent-based asphalt dampproofing work shall not be performed in temperatures below 4 degrees C. Dampproofing materials shall be applied in accordance with manufacturer's published instructions to produce a smooth uniform dry film not less than 0.3 mm (12 mils) thick without voids or defects. Dull or porous spots shall be recoated. Dampproofing materials shall seal tightly around pipes and other items projecting through dampproofing. Rates of application shall be as follows:

- a. Primer: 0.4 liters per square meter, cold-applied.
- b. Dampproofing Coat: 0.8 liters per square meter, cold-applied with spray, brush or trowel.
- c. Apply one coat of primer at a rate of 4.9 to 7.4 square meter per liter, and allow to dry.
- d. Form flashings at outside corners, changes in plane, and penetrations larger than 12.7 mm diameter. Apply coating of dampproofing or detailing mastic, embed layer of fiberglass reinforcing extending at least 304.8 mm onto dampproofing surface, and topcoat with another layer of dampproofing or detailing mastic.
- e. Form 9.525 mm fillet of detailing mastic around penetrations 12.7 mm in diameter or smaller.
- f. Apply two coats of cold-applied fibrated semi mastic cut-back asphalt dampproofing at the rate of 1/2 square meter per liter, per coat.

3.3 INSPECTION

Before concealing dampproofing, notify the Architect that the dampproofing is ready for inspection.

3.4 CLEAN-UP

Surfaces of other work which are stained with dampproofing materials shall be cleaned with a cleaner recommended by dampproofing manufacturer.

3.5 PROTECTION

The completed dampproofing work shall be protected from damage during and

after construction.

-- End of Section --

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SECTION 07191

VAPOR RETARDERS

07/01

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SECTION 07191

VAPOR RETARDERS

07/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. All the latest versions of the referenced publications shall be used.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 920	Elastomeric Joint Sealants
ASTM D 882	Tensile Properties of Thin Plastic Sheeting
ASTM D 1709	Impact Resistance of Plastic Film by the Free-Falling Dart Method
ASTM D 2582	Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting
ASTM D 3776	Mass per Unit Area (Weight) of Woven Fabric
ASTM D 4833	Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM E 96	Test Methods for Water Vapor Transmission of Materials
ASTM E 1643	Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
ASTM E 1745	Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs

SEALANT, WATERPROOFING AND RESTORATION INSTITUTE (SWRI)

SWRI	Sealant and Caulking Guide Specification
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1.2 SYSTEM DESCRIPTION

Materials and installation methods to provide protection from water, mildew and moisture penetration into the building. To seal gaps between enclosure components and opening frames. The system combines exterior gypsum board, batt insulation facing, inherent insulation qualities, sheet goods and accessories to prevent vapor penetration.

1.3 PERFORMANCE REQUIREMENTS

Maximum Vapor Permeability (Perm) 1 ng/S/m/pa measured in accordance with

ASTM E 96, Method E.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-01 Preconstruction Submittals

Submit all information before the pre-installation conference to be held 45 days prior to installation.

SD-03 Product Data

Reinforced vapor retarder: ~~G-A/E~~

Provide data indicating material characteristics, performance criteria, limitations, and installation methods.

SD-08 Manufacturer's Instructions

Indicate preparation and installation requirements, techniques.

1.5 QUALITY ASSURANCE

Convene a pre-installation meeting 2 weeks before start of installation of reinforced vapor retarders. Require attendance of parties directly affecting work of this section, including Contractor, Contracting Officer, and Installer. Review installation, protection, and coordination with other work.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

2.1.1 Reinforced Vapor Retarders Above Grade

Sheet Retarder Type 1 opaque or translucent laminated reinforced membrane film for above grade application, having a maximum perm rating of 1.0.

2.1.2 Reinforced Vapor Retarders Under Slab

ASTM E 1643, 5-ply laminate, combining 3 layers of rubber-modified high-density polyethylene and 2 high-strength non-woven cord grids. Weight per ASTM D 3776, 25 kg/100 sq.m. Puncture propagation tear, per ASTM D 2582, 111 N. Permeance (Perm), per ASTM E 96, 1.551 ng/(Pa-s-sq.m). Drop Dart, per ASTM D 1709, 1200 g. Tensile strength, per ASTM D 882, 823 N/34, 323 kPa. Puncture strength, per ASTM D 4833, 191 N. Classification per ASTM E 1745, Class B. Usable temperature range -40 to 77 degrees C.

2.2 ADHESIVES

Mastic Adhesive or Tape. Non-solvent type, compatible with sheet barrier and substrate, thick mastic of uniform consistency.

2.3 ACCESSORIES

2.3.1 Thinner and Cleaner for Neoprene Sheet

As recommended by sheet material manufacturer.

2.3.2 Tape

Bright aluminum self-adhering type, mesh reinforced, 50 mm wide, compatible with sheet material.

PART 3 EXECUTION

3.1 EXAMINATION

Verify condition of substrate and adjacent materials. Notify Contracting Officer if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.2 PREPARATION

Remove loose or foreign matter which might impair adhesion. Clean and prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.

3.3 INSTALLATION

Install materials in accordance with manufacturer's instructions. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges or where compatibility with adjacent materials may be in doubt.

3.3.1 Vapor Retarder For Stud Framed Walls

Secure sheet barrier Type 1 to stud faces with adhesive. Lap edges over stud faces, lap ends onto adjacent construction; tape ends with non-solvent adhesive to ensure complete seal.

3.3.2 Vapor Retarder Seal For Openings

Install sheet barrier Type 1 between window and door frames and adjacent vapor retarder and seal with adhesive. Position laps over firm bearing.

-- End of Section --

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SECTION 07210

BUILDING INSULATION

09/99

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SECTION 07210

BUILDING INSULATION

09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. All the latest versions of the referenced publications shall be used.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 165	Measuring Compressive Properties of Thermal Insulations
ASTM C 272	Water Absorption of Core Materials for Structural Sandwich Constructions
ASTM C 552	Cellular Glass Thermal Insulation
ASTM C 578	Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 612	Mineral Fiber Block and Board Thermal Insulation
ASTM C 665	Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 930	Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM C 1289	Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D 3833/D 3833M	Water Vapor Transmission of Pressure-Sensitive Tapes
ASTM E 84	Surface Burning Characteristics of Building Materials
ASTM E 96	Water Vapor Transmission of Materials

ASTM E 136 Behavior of Materials in a Vertical Tube
Furnace at 750 Degrees C

ASTM E 154 Water Vapor Retarders Used in Contact with
Earth Under Concrete Slabs, on Walls, or
as Ground Cover

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.134 Respiratory Protection

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31 Installation of Oil Burning Equipment

NFPA 70 National Electrical Code

NFPA 211 Chimneys, Fireplaces, Vents, and Solid
Fuel Burning Appliances

UNIFORM BUILDING CODE (UBC)

UBC 26-9 Method of Test for the Evaluation of
Flammability Characteristics of Exterior
Non load-Bearing Wall Assemblies
Containing Combustible Components Using
the Intermediate-Scale Multistory Test
Apparatus.

UNDERWRITERS LABORATORIES INC. (UL)

UL 2079 Standard Tests for Fire Resistance of
Building Joint Systems

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal
Procedures."

SD-03 Product Data

Batt Insulation

Block or board insulation

Accessories

SD-08 Manufacturer's Instructions

Batt Insulation

Block or Board Insulation

Adhesive

1.3 SYSTEM DESCRIPTION

The roof insulation is specified under the section entitled "ROOF INSULATION". The steel stud/masonry veneer has batt insulation thickness as indicated on the drawings. Specifically, the partition types use unfaced fiberglass batt insulation. The composite masonry wall has cavity insulation. Use 50 mm of polyisocyanurate board insulation. The foundation is insulated with polystyrene, 50 mm, with suitable face finish to meet underground conditions in accordance with ASTM E 154.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials to the site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.4.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

1.5 SAFETY PRECAUTIONS

1.5.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in accordance with 29 CFR 1910.134.

1.5.2 Other Safety Considerations

Consider safety concerns and measures as outlined in ASTM C 930.

PART 2 PRODUCTS

2.1 BOARD INSULATION

Provide only thermal insulating materials recommended by manufacturer for type of application indicated. Provide board or block thermal insulation conforming to the following standards and the physical properties listed below:

- a. Extruded Preformed Cellular Polystyrene: ASTM C 578
- b. Unfaced Preformed Rigid Polyisocyanurate Board: ASTM C 591

- c. Faced Rigid Cellular Polyisocyanurate and Polyurethane Insulation:
ASTM C 1289 and ASTM C 165 for density requirements.

Type I Aluminum Foil on outside surfaces.

2.1.1 Thermal Resistance of Insulation

Wall R metric - 2.47; Slab edge R metric - 1.76.

2.1.2 Fire Protection Requirement

- a. Flame spread index of 25 or less when tested in accordance with
ASTM E 84, UL 2079, and UBC 26-9 for requirements for assemblies.

2.1.3 Other Material Properties

Provide thermal insulating materials with the following properties:

- a. Water Vapor Permeance: Not more than 6.3×10^{-8} g/Pa.s.m² or less
when measured according to ASTM E 96, desiccant method, in the
thickness required to provide the specified thermal resistance,
including facings, if any in accordance with ASTM E 154.
- b. Water Absorption: Not more than 2 percent by total immersion, by
volume, when measured according to ASTM C 272.

2.1.4 Recycled Materials

Provide thermal insulation containing recycled materials to the extent
practicable, provided that the material meets all other requirements of
this section. The minimum required recycled material contents (by weight,
not volume) are:

Polyisocyanurate/Polyurethane: 9 percent

2.1.5 Prohibited Materials

Do not provide materials containing more than one percent of asbestos.

2.2 Glass Fiber Insulation-Blanket/Batt

Blanket/batt. Type I, (ASTM C 665); blanket/batt must pass ASTM E 136
combustion test requirements.

Total R-value varies, see drawings.

R metric - 4.58 - 200 mm cavity walls.

R metric 1.94 - 90 mm cavity walls.

R metric 3.35 - 150 mm cavity walls.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Blocking Around Heat Producing Devices

Unless using insulation board that passes ASTM E 136 in addition to the requirements in Part 2, install non-combustible blocking around heat producing devices to provide the following clearances:

- a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: 75 mm from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 600 mm above fixture.
- b. Vents and vent connectors used for venting products of combustion, flues, and chimneys other than masonry chimneys: minimum clearance as required by NFPA 211.
- g. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking is not required if chimneys or flues are certified by the Manufacturer for use in contact with insulating materials.

3.2 INSTALLATION

3.2.1 Insulation Board

Install and handle insulation in accordance with the manufacturer's installation instructions. Keep material dry and free of extraneous materials. Observe safe work practices.

3.2.2 Electrical Wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.2.3 Cold Climate Requirement

Place insulation to the outside of pipes.

3.2.4 Continuity of Insulation

Butt tightly against adjoining boards, studs, rafters, joists, sill plates, headers and obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joint, roof, and floor. Avoid creating any thermal bridges or voids. Foil sided board should face out in exterior walls.

3.3 INSTALLATION ON WALLS

3.3.1 Installation using Furring Strips

Install insulation on members as recommended by insulation manufacturer.

3.3.2 Installation on Masonry Walls

Apply board directly to masonry over bituminous dampproofing with adhesive or fasteners as recommended by the insulation manufacturer. Fit between obstructions without impaling board on ties or anchors. Apply in parallel courses with joints breaking midway over course below. Put ends in moderate contact with adjoining insulation without forcing. Cut and shape as required to fit around wall penetrations, projections or openings to accommodate conduit or other services. Seal around cut-outs with sealant. Install board in wall cavities so that it leaves at least a nominal 25 mm free air space outside of the insulation to allow for cavity drainage.

3.3.3 Mechanical Attachment on Concrete and Masonry Walls

Cut insulation to cover walls. Apply adhesive to wall and set clip or other mechanical fastener in adhesive as recommended by manufacturer. After curing of adhesive, install insulation over fasteners, bend split prongs flush with insulation. Butt all edges of insulation and seal with tape.

3.4 PERIMETER AND UNDER SLAB INSULATION

Install perimeter thermal insulation where heated spaces are adjacent to exterior walls or slab edges in slab-on-grade or floating-slab construction.

3.4.1 Manufacturer's Instructions

Install, attach, tape edges, provide vapor retarder and other requirements such as protection against vermin, insects, damage during construction as recommended in manufacturer's instructions.

3.4.2 Insulation on Vertical Surfaces

Install thermal insulation as indicated. Fasten insulation with adhesive.

3.4.3 Insulation Under Slab

Provide insulation horizontally under slab on grade for a distance of 600 mm from the edge of slab. Turn insulation up at slab edge, and extend full height of slab. Install insulation on top of vapor retarder and turn retarder up over the outside edge of insulation to top of slab.

3.4.4 Protection of Insulation

Protect insulation on vertical surfaces from damage during construction and back filling by application of protection board or coating. Do not leave installed vertical insulation unprotected overnight. Install protection over entire exposed exterior insulation board.

3.5 VAPOR RETARDER

Apply a continuous vapor retarder as specified in Section 07191 Vapor Retarders. Overlap all joints at least 150 mm and seal with pressure sensitive tape. Seal at sill, header, windows, doors and utility penetrations. Repair punctures or tears with pressure sensitive tape.

3.6 ACCESS PANELS AND DOORS

Affix insulation to all access panels greater than 0.1 square meter and all access doors in insulated floors and ceilings. Use insulation with same R-Value as that for floor or ceiling.

-- End of Section --

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SECTION 07220A

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04/01

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SECTION 07220A

ROOF INSULATION

04/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A208.1 (1999) Particleboard Mat Formed Woods

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 208 (1995) Cellulosic Fiber Insulating Board

ASTM C 726 (2000) Mineral Fiber Roof Insulation Board

ASTM C 1289 (1998) Faced Rigid Cellular
Polyisocyanurate Thermal Insulation Board

ASTM D 41 (1994) Asphalt Primer Used in Roofing,
Dampproofing, and Waterproofing

ASTM D 226 (1997a) Asphalt-Saturated Organic Felt
Used in Roofing and Waterproofing

ASTM D 312 (2000) Asphalt Used in Roofing

ASTM D 2178 (1997a) Asphalt Glass Felt Used in Roofing
and Waterproofing

ASTM D 4586 (1993; R 1999) Asphalt Roof Cement,
Asbestos Free

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P9513 (1996) Loss Prevention Data for Roofing
Contractors

FM P7825a (1998) Approval Guide Fire Protection

FM P7825c (1998) Approval Guide Building Materials

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir

(1999) Building Materials Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Application of Insulation

Insulation manufacturer's recommendations for the application and installation of insulation.

Inspection

The inspection procedure for insulation installation, prior to start of roof insulation work.

SD-07 Certificates

Insulation

Glass Roofing Felt

Organic Roofing Felt

Certificate attesting that the expanded polyisocyanurate insulation contains recovered material and showing estimated percent of recovered material. Certificates of compliance for felt materials. Roofing system manufacturer's written acceptance of proposed insulation, facer material, adhesives, and procedures for installation.

1.3 STORAGE OF MATERIALS

Insulation materials shall be stored in accordance with manufacturer's instructions. Insulation, base sheet, and felt shall be kept dry at all times, before, during, and after delivery to the site and shall be stored in an enclosed building or in a closed trailer. Wet insulation, wet base sheet or wet felt shall be permanently removed from the site. Wet insulation is defined by a reading of 15 percent or higher on a hand-held moisture reader. Felts shall be stacked on end one level high. Felt rolls shall be maintained at a temperature above 10 degrees C for 24 hours immediately before laying.

1.4 FIRE CLASSIFICATION

Insulation shall have been tested as part of a roof construction assembly of the type used in this project, and the construction shall be listed as Class I in FM P7825a.

PART 2 PRODUCTS

2.1 INSULATION

Insulation shall be a standard product of the manufacturer and shall be factory marked with the manufacturer's name or trade mark, the material specification number, the R-value at 24 degrees C, and the thickness. Minimum thickness shall be as recommended by the manufacturer. Boards shall be marked individually. The thermal resistance of insulation shall be not less than the R-value shown on the drawings. The insulation manufacturing process shall not include chlorofluoro- carbons (CFC) or formaldehydes. Insulation shall be one, or a combination of the following materials:

2.1.1 Fiberboard

ASTM C 208 Type II, Grade 1, roof insulating board with a minimum recovered material content of 80-percent, treated with sizing, wax or bituminous impregnation. Bituminous impregnation shall be limited to 4 percent by weight when used over steel decks.

2.1.2 Polyisocyanurate

ASTM C 1289, Type I, having minimum recovered material content of 9-percent by weight of the polyisocyanurate portion of the board.

2.2 FASTENERS

Fasteners shall be specifically designed screws and plates or spikes and plates of sufficient length to hold insulation securely in place. Fasteners shall conform to insulation manufacturer's recommendations except that holding power, when driven, shall be not less than 534 N each in steel deck. Fasteners for steel decks shall conform to FM P7825c for Class I roof deck construction, and shall be spaced to withstand an uplift pressure of 4.3 kPa.

2.3 WOOD NAILERS

Wood nailers shall conform to Section 06114 WOOD BLOCKING AND CURBING, including preservative treatment. Edge nailers shall be not less than nominal 150 mm wide and of thickness to finish flush with the top surface of the insulation. Surface mounted nailers shall be a nominal 75 mm wide by the full thickness of the insulation.

PART 3 EXECUTION

3.1 COORDINATION REQUIREMENTS

Insulation and roofing membrane shall be finished in one operation up to the line of termination at the end of each day's work. Completed sections shall be glaze coated when more than one day is required to finish the roofing. Phased construction will not be permitted.

3.2 ENVIRONMENTAL CONDITIONS

The temperature of the roofing materials shall be as required by the manufacturer. Air temperature shall be above 4 Degrees C and there shall be no visible ice, frost, or moisture on the roof deck when the insulation and roofing are installed. Wind conditions shall be suitable for installation of insulation: Wind chill may affect the proper application temperatures of materials; hot materials may be blown about, creating safety dangers; insulation boards may become difficult and hazardous to handle; wrappers, coverings, and other debris may become airborne, and possibly contaminate laps and seams.

3.3 SUBSTRATE PREPARATION

The substrate construction of any bay or section of the building shall be completed before insulation or vapor retarder work is begun thereon. Insulation or vapor retarder to be applied directly on concrete shall not be scheduled until joints have been grouted, deck has been primed and allowed to dry, frothing or bubbling does not occur when hot bitumen is applied to the concrete and until the hot bitumen sticks tightly to the concrete. Vents and other items penetrating the roof shall be secured in position and properly prepared for flashing. Prior to application of vapor retarder or insulation, substrate joints shall be covered with a 100 mm strip of roofing felt, embedded in and coated with asphalt cement. Substrate surface shall be smooth, clean, and dry at time of application.

3.4 HEATING OF ASPHALT

Asphalt shall not be heated higher than 42 degrees C above the EVT or 28 degrees C below the flash point, or 275 degrees C, whichever is lower. EVT and flash point temperatures of asphalt in the kettle shall be conspicuously posted on the kettle. Kettle shall be provided with automatic thermostatic controls and an accurate thermometer. Kettle operators shall be in attendance at all times during heating to ensure that the maximum temperature is not exceeded. Asphalt shall be applied within a range of 14 degrees C below or above the EVT, or as specified by the manufacturer. Application temperature shall be measured at the mop bucket or mechanical applicator. Asphalt at a temperature below this range shall be returned to the kettle. Flame-heated equipment shall not be placed on the roof.

3.5 VAPOR RETARDER

3.5.1 General Application

Vapor retarder shall consist of two plies of roofing felt, mopped at right angle to the slope, with 150 mm end laps staggered at least 300 mm. The full 475 mm starter ply and full 900 mm wide ply sheets shall be placed, in succession, in hot asphalt immediately behind the applicator. Each ply shall be solid mopped in not less than 0.97 kg nor more than 1.46 kg of asphalt per square meter. A follow tool shall be used with glass felts and a broom shall be used with organic felts to embed the felts, eliminate air pockets and obtain adhesion between the plies. Side and end laps shall be completely sealed. Asphalt shall be visible beyond all edges of each ply as it is being installed. Plies shall be laid free of wrinkles, creases or

fishmouths. Workers shall not walk on mopped surfaces when the asphalt is sticky. For slopes exceeding 42 mm/m, some manufacturers allow or require that the felts be run parallel to the slope and that they be nailed off into strategically installed nailers which are perpendicular to the slope; each ply shall be nailed 50 mm and 150 mm from the upper edge with nails spaced 300 mm on centers and staggered in each row.

3.5.2 Edge Requirements

At walls, eaves and rakes, the vapor retarder organic felts shall be extended 225 mm, or separate organic felt plies shall be extended 225 mm, with not less than 225 mm on the substrate, and the extended portion turned back and mopped in over the top of the insulation. At roof penetrations other than walls, eaves and rakes, the vapor retarder or separate plies shall be extended 225 mm to form a lap which shall later be folded back over the edge of the insulation. Asphalt roof cement shall be used under the vapor retarder for at least 225 mm from walls, eaves, rakes and other penetrations.

3.6 INSTALLATION OF WOOD NAILERS

Nailers shall be secured to cast-in-place deck materials by not less than 9 mm diameter anchors embedded in the deck not over 1.2 meters on centers. Nailers shall be secured to precast deck materials and to steel decks as indicated. Bolt anchors shall have nuts and washers countersunk, and bolts shall be cut flush with top of nailer. Powder-actuated fasteners, sized and spaced for nailer anchorage equivalent to that specified and indicated, may be used when approved. Surface mounted nailers shall be installed parallel with the roof slope and shall be spaced not over 1.2 meters face-to-face, except that where the insulation units are less than 1.2 meters in length the nailers shall be spaced to minimize cutting of the insulation. On sloped roofs exceeding 62.5 mm per meter for modified bituminous systems and 83 mm per meter for BUR systems, nailers shall be installed in accordance with the recommendations of the membrane system manufacturer.

3.7 APPLICATION OF INSULATION

Insulation shall be laid in two or more layers. Units of insulation shall be laid in courses parallel with the roof slope. End joints shall be staggered. Insulation shall be cut to fit neatly against adjoining surfaces. Joints between insulation boards shall not exceed 6 mm. Joints in successive layers shall be staggered with respect to joints of preceding layer. Any open joints wider than 6 mm shall be filled with cut pieces of insulation, then a layer of asphalt roof cement applied. Where insulation is applied over steel deck, long edge joints shall continuously bear on surfaces of the steel deck. Insulation which can be readily lifted after installation is not considered to be adequately secured. Insulation shall be applied so that all roof insulation applied each day is waterproofed the same day. Phased construction will not be permitted. Application of impermeable faced insulation shall be performed without damage to the facing.

3.7.1 Mechanical Fastening

On steel decks, for any slope exceeding 40 mm/m, the first layer of insulation shall be mechanically fastened. Method of attachment shall be in accordance with recommendations of the insulation manufacturer and requirements specified.

3.7.2 Steel Decks

All steel decks shall be insulated before receiving a roof membrane. Uninsulated steel decks shall have insulation applied to span the steel deck flutes and to act as an underlayment for the roof membrane. First layer of insulation on steel deck shall be compatible with mechanical fastening and shall meet fire resistant requirements.

3.7.3 Foam Insulation

Polyisocyanurate insulation shall be isolated from built-up roof by a separate or composite layer of fiberboard.

3.7.4 Installation

Except for the first layer on steel deck, insulation layers shall be laid in solid moppings of hot asphalt applied at a rate of at least 0.97 kg per meter (20 lbs per square). Asphalt shall not be applied further than one panel length ahead of roof insulation being installed. Where roof slopes are greater than 40 mm/m, roof insulation shall be held in place by mechanical fasteners.

3.7.5 Protection Requirements

The insulation shall be kept dry at all times. Insulation boards shall not be kicked into position. Exposed edges of the insulation shall be protected by cutoffs at the end of each work day or whenever precipitation is imminent. Cutoffs shall be 2 layers of bituminous-saturated felt set in plastic bituminous cement. Cutoffs shall be removed when work is resumed. Edges of insulation at open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, shall be protected until permanent roofing and flashing is applied. Storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces will not be permitted. Smooth, clean board or plank walkways, runways, and platforms shall be used, as necessary to distribute weight to conform to indicated live load limits of roof construction. See structural documents for data.

3.8 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roof insulation with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.

b. Verification of certification, listing or label compliance with FM P9513.

c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.

d. Inspection of vapor retarder application, including edge envelopes and mechanical fastening.

e. Inspection of mechanical fasteners; type, number, length, and spacing.

f. Coordination with other materials, cants, sleepers, and nailing strips.

g. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.

h. Installation of cutoffs and proper joining of work on subsequent days.

i. Continuation of complete roofing system installation to cover insulation installed same day.

-- End of Section --

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DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07245

EXTERIOR FINISH SYSTEMS

10/01

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SECTION 07245

EXTERIOR FINISH SYSTEMS
10/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM C 67	(2000) Sampling and Testing Brick and Structural Clay products
ASTM C 150	(2000) Portland Cement
ASTM C 473	(2000) Physical Testing of Gypsum Panel Products
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 847	1995 Metal Lath
ASTM C 920	(1998) Elastomeric Joint Sealants
ASTM C 1177/C 1177M	(1999) Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C 1186	(1999; Rev. A) Flat Non-Asbestos Fiber-Cement Sheets
ASTM D 968	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D 2247	(1999) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 3273	(2000) Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
ASTM E 84	(2000) Surface Burning Characteristics of Building Materials
ASTM E 136	(1999) Behavior of Materials in Vertical Tube Furnace at 750 Degrees C
ASTM E 330	(1997) Structural Performance of Exterior

Windows, Curtain Walls, and Doors by
Uniform Static Air Pressure Difference

ASTM E 331

(2000) Water Penetration of Exterior
Windows, Curtain Walls, and Doors by
Uniform Static Air Pressure Difference

ASTM E 695

(1997) Measuring Relative Resistance of
Wall, Floor, and Roof Construction to
Impact Loading

ASTM G 23

(1996) Operating Light-Exposure Apparatus
(Carbon-Arc Type) with and Without Water
for Exposure of Nonmetallic Materials

EXTERIOR INSULATION MANUFACTURERS ASSOCIATION (EIMA)

EIMA TM 101.01

(1995) Freeze/Thaw Resistance of Exterior
Insulation and Finish Systems (EIFS),
Class PB.

EIMA TM 101.86

(1995, Rev. Aug. 1995) Resistance of
Exterior Insulation and Finish Systems,
Class PB, to the Effects of Rapid
Deformation (Impact)

EIMA TM 105.01

(1995) Alkali Resistance of Glass Fiber
Reinforcing Mesh for Use in Exterior
Insulation and Finish Systems

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

UBC 26-4

Evaluation of Flammability Characteristics
of Exterior, Non load-Bearing Wall Panel
Assemblies using Foam Plastic Insulation

UBC 26-9

Evaluation of Flammability Characteristics
of Exterior Non load-Bearing Wall
Assemblies Containing Combustible
Components using Intermediate-Scale,
Multistory Test Apparatus Title

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 268

(1996) Determining Ignitability of
Exterior Wall Assemblies Using a Radiant
Heat Energy Source

1.2 SYSTEM DESCRIPTION AND REQUIREMENTS

The exterior finish system (EFS or EIFS) shall be a job-fabricated exterior wall covering consisting of sheathing, reinforcing fabric, base coat, finish coat, adhesive and mechanical fasteners as applicable. The system components shall be compatible with each other and with the substrate as recommended or approved by, and the products of, a single manufacturer regularly engaged in furnishing Exterior Finish Systems. All materials shall be installed by an applicator approved by the system manufacturer. Finish shall be white in color and have a sand texture similar to stucco.

1.2.1 System Requirements and Tests

The system shall meet the performance requirements as verified by the tests listed below. Where a wall system of similar type, size, and design as specified for this project has been previously tested under the condition specified herein, the resulting test reports may be submitted in lieu of job specific tests.

1.2.1.1 Water Penetration

Test the system for water penetration by uniform static air pressure in accordance with ASTM E 331. There shall be no penetration of water beyond the plane of the base coat interface after 15 minutes at 300 Pa (, or 20% of positive design wind pressure, whichever is greater.

1.2.1.2 Mock-Up Installation

Complete mock-up installation 1200 mm high by 1200 mm wide, including typical control joints. Control joints to be filled with sealant of type, manufacturer, and color selected. Construct mock-up installation at job site. Build mock-up to comply with the following requirements, using materials indicated for the completed work:

- a. Locate mock-up installation in the location and size indicated.
- b. Demonstrate the proposed range of color, texture, thickness, and workmanship.
- c. Obtain Contracting Officer's written approval of mock-up before starting final work.
- d. Maintain mock-up installation during construction as a standard for judging the completed work by protecting it from weather and construction activities.
- e. When directed, demolish and remove mock-up from the site.

1.2.2 Component Requirements and Tests

The components of the system shall meet the performance requirements as verified by the tests listed below.

1.2.2.1 Surface Burning Characteristics

Conduct ASTM E 84 test on samples consisting of base coat, reinforcing fabric, and finish coat. Cure for 28 days. The flame spread index shall be 25 or less and the smoke developed index shall be 450 or less.

1.2.2.2 Radiant Heat

The system shall be tested in accordance with NFPA 268 with no ignition during the 20-minute period.

1.2.2.3 Impact Resistance

- a. Impact Mass: Test 28 day cured specimen of PM EIFS in accordance with ASTM E 695. The test specimen shall exhibit no cracking or denting after twelve impacts by 13.6 kg lead shot mass from 150 to 1800 mm drop heights in 150 mm intervals.

1.2.3 Sub-Component Requirements and Tests

Unless otherwise stated, the test specimen shall consist of reinforcement, base coat, and finish coat applied in accordance with manufacturer's printed recommendations directly to the sheathing board without insulation.

For mildew resistance, only the finish coat is applied onto glass slides for testing. These specimen shall be suitably sized for the apparatus used and be allowed to cure for a minimum of 28 days prior to testing.

1.2.3.1 Abrasion Resistance

Test in accordance with ASTM D 968, Method A. Test a minimum of two specimen. After testing, the specimens shall show only very slight smoothing, with no loss of film integrity after 500 liters of water.

1.2.3.2 Accelerated Weathering

Test in accordance with ASTM G 23, Method 1. After 2000 hours specimens shall exhibit no visible cracking, flaking, peeling, blistering, yellowing, fading, or other such deterioration.

1.2.3.3 Mildew Resistance

Test in accordance with ASTM D 3273. The specimen shall consist of the finish coat material, applied to clean 75 mm by 100 mm glass slides and shall be allowed to cure for 28 days. After 28 days of exposure, the specimen shall not show any growth.

1.2.3.4 Salt Spray Resistance

Test in accordance with ASTM B 117. The specimen shall be a minimum of 100 mm by 150 mm and shall be tested for 300 hours. After exposure, the specimen shall exhibit no observable deterioration, such as chalking, fading, or rust staining.

1.2.3.5 Water Resistance

Test in accordance with ASTM D 2247. The specimen shall be a minimum of 100 mm by 150 mm. After 14 days, the specimen shall exhibit no cracking, checking, crazing, erosion, blistering, peeling, or delamination.

1.2.3.6 Absorption-Freeze/Thaw

Class PM systems shall be tested in accordance with ASTM C 67 for 50 cycles of freezing and thawing. After testing, the specimens shall exhibit no cracking or checking, and have negligible weight gain.

1.2.4 Moisture Analysis

Perform a job specific vapor transmission analysis based on project specific climate and specified wall components and materials. Indicate the temperatures and relative humidities for the inside and outside of the building; a complete listing of the building components, their thickness, thermal resistance and permeance, as well as building location and use. If a mathematical model was used for the analysis, include the name of the model and the supplier/developer.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

*8

SD-02 Shop Drawings

Shop drawings:~~C A/E~~

Show ceiling layout, construction and expansion joints, decorative grooves, layout of sheathing board, reinforcement mesh and strip reinforcing fabric; joint and flashing details; details at ceiling penetrations; types and location of fasteners; and details at corners.

SD-03 Product Data

Sheathing board:~~C A/E~~

Adhesive:~~C A/E~~

Mechanical Fasteners:~~C A/E~~

Accessories:~~C A/E~~

Base coat:~~C A/E~~

Portland cement:~~C A/E~~

Reinforcing fabric:~~C A/E~~

Finish coat:~~C A/E~~

Joint Sealant:~~C A/E~~

Primer:~~C A/E~~

Bond breaker:~~C A/E~~

Backer Rod:~~C A/E~~

Warranty

Include joint and other details such as end conditions. Include shelf life and recommended cleaning solvents in data for sealants.

Include material safety data sheets (MSDS) for all components of the EIFS. The MSDS shall be available at the job site.

SD-05 Design Data

Moisture analysis Calculations

SD-06 Test Reports

Abrasion resistance

Accelerated weathering

Impact resistance

Mildew resistance

Salt spray resistance

Water vapor transmission

Absorption-freeze-thaw

Flame spread

Water penetration

Water resistance

Flame spread

Surface Burning Characteristics

Radiant heat

SD-07 Certificates

Qualifications of EIFS Manufacturer

Qualification of EIFS Installer

Qualification of Sealant Applicator

Certify that EIFS installer meets requirements specified under paragraph "Qualification of Installer," and that sealant applicator is approved by the EIFS Manufacturer.

SD-08 Manufacturer's Instructions

Installation

Manufacturer's standard printed instructions for the installation of the EIFS. Include requirements for condition and preparation of substrate, installation of EIFS, and requirements for sealants and sealing.

SD-10 Operation and Maintenance Data

EIFS

Include detailed finish repair procedures and information regarding compatibility of sealants with base and finish coatings.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications of EIFS Manufacturer

The EIFS shall be the product of a manufacturer who has been in the practice of manufacturing and designing EIFS for a period of not less than 3 years, and has been involved in at least five projects similar to this project in size, scope, and complexity, in the same or a similar climate as this project.

1.4.2 Qualification of EIFS Installer

The EIFS Installer shall be trained and approved by the EIFS manufacturer to install the system and shall have successfully installed at least five projects at or near the size and complexity of this project. The contractor shall employ qualified workers trained and experienced in installing the manufacturer's EIFS.

1.4.3 Qualification of Sealant Applicator

The sealant applicator shall be experienced and competent in the installation of high performance industrial and commercial sealants and shall have successfully installed at least five projects at or near the size and complexity of this project.

1.5 DELIVERY AND STORAGE

Deliver materials to job site in original unopened packages, marked with manufacturer's name, brand name, and description of contents. Store materials off the ground and in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area. Protect stored materials from rain, sunlight, and excessive heat. Keep coating materials which would be damaged by freezing at a temperature not less than 4 degrees C.

1.6 ENVIRONMENTAL CONDITIONS

- a. Do not prepare materials or apply EIFS during inclement weather unless appropriate protection is provided. Protect installed materials from inclement weather until they are dry.
- b. Apply sealants and wet materials only at ambient temperatures of 4 degrees C or above and rising, unless supplemental heat is provided. The system shall be protected from inclement weather and to maintain this temperature for a minimum of 24 hours after installation.

1.7 WARRANTY

Furnish manufacturer's standard warranty for the EIFS. Warranty shall run directly to Government and cover a period of not less than 5 years from date Government accepted the work.

PART 2 PRODUCTS

2.1 COMPATIBILITY

Provide all materials compatible with each other and with the substrate, and as recommended by EIFS manufacturer.

2.2 SHEATHING BOARD

2.2.1 Glass Mat Gypsum Sheathing Board

- a. Conform to ASTM C 1177/C 1177M.
- b. Nail Pull Resistance: No less than 534 N (when tested in accordance with ASTM C 473.

2.3 ADHESIVE

Manufacturer's standard product, including primer as required, and shall be compatible with substrate and insulation board to which the system is applied.

2.4 MECHANICAL FASTENERS

Corrosion resistant and as approved by EIFS manufacturer. Select fastener type and pattern based on applicable wind loads and substrate into which fastener will be attached, to provide the necessary pull-out, tensile, and shear strengths.

2.5 BASE COAT

Manufacturer's standard product and compatible with other systems components.

2.6 PORTLAND CEMENT

Conform to ASTM C 150, Type I or II as required, fresh and free of lumps, and approved by the systems manufacturer.

2.7 REINFORCING FABRIC

Reinforcing fabric mesh shall be alkali-resistant, balanced, open weave, glass fiber fabric made from twisted multi-end strands specifically treated for compatibility with the other system materials, and comply with EIMA TM 105.01 and as recommended by EIFS manufacturer.

2.8 FINISH COAT

Manufacturer's standard product conforming to the requirements in the paragraph on Sub-Component Requirements and Tests. For color consistency, use materials from the same batch or lot number.

2.9 PRIMER

Non-staining, quick-drying type recommended by sealant manufacturer and EIFS manufacturer.

2.10 ACCESSORIES

Conform to recommendations of EIFS manufacturer, including trim, edging, anchors, expansion joints. All metal items and fasteners to be corrosion resistant.

2.11 JOINT SEALANT

Non-staining, quick-drying type meeting ASTM C 920, Class 25, compatible with the finish system type and grade, and recommended by both the sealant manufacturer and EIFS manufacturer.

2.12 BOND BREAKER

As required by EIFS manufacturer and recommended by sealant manufacturer and EIFS manufacturer.

2.13 BACKER ROD

Closed cell polyethylene free from oil or other staining elements and as recommended by sealant manufacturer and EIFS manufacturer. Do not use absorptive materials as backer rod. The backer rod should be sized 25 percent larger than the width of the joint.

PART 3 EXECUTION

3.1 INSTALLATION

Install EIFS as indicated, comply with manufacturer's instructions except as otherwise specified, and in accordance with the shop drawings. EIFS shall be installed only by an applicator trained and approved by the EIFS manufacturer. Specifically, include all manufacturer recommended provisions regarding flashing and treatment of wall penetrations.

3.1.1 Sheathing Board

Edges and ends of boards shall be butted snugly with joints staggered. Do not align sheathing board joints with ceiling openings. Provide support at both side and end joints. Attach sheathing board to metal framing with self-tapping drywall screws. Place fasteners sufficiently close to support imposed loads, but not more than:

- a. 200 mm apart on each supporting member.

Space fasteners more closely when required for negative wind load resistance.

3.1.2 Base Coat and Reinforcing Fabric Mesh,

3.1.2.1 Class PM Systems

Mechanically fasten reinforcing fabric mesh to the sheathing using the type and spacing of fasteners specified in the manufacturer's instructions. Provide diagonal reinforcement at opening corners. Mix base coat in accordance with manufacturer's instructions. Apply base coat in accordance with manufacturer's instruction to provide a complete, tight coating of uniform thickness as specified by the manufacturer. Cover all fiberglass reinforcing fabric, including at back wrapped areas at panel joints and at fasteners.

3.1.3 Finish Coat

Apply and level finish coat in one operation. Obtain final texture by trowels, floats, or by spray application as necessary to achieve the required finish matching approved mock-up installation. Apply the finish coat to the dry base coat maintaining a wet edge at all times to obtain a uniform appearance. The thickness of the finish coat shall be in accordance with the system manufacturer's current published instructions. Apply finish coat so that it does not cover surfaces to which joint sealants are to be applied. The base coat/reinforcing mesh must be allowed to dry a minimum of 24 hours prior to the application of the finish coat. Surface irregularities in the base coat, such as trowel marks, board lines, reinforcing mesh laps, etc., shall be corrected prior to application of the finish coat.

3.2 JOINT SEALING

Seal EIFS at openings as recommended by the system manufacturer. Apply

sealant only to the base coat. Do not apply sealant to the finish coat.

3.2.1 Surface Preparation, Backer Rod, and Primer

Immediately prior to application, remove loose matter from joint. Ensure that joint is dry and free of paint, finish coat, or other foreign matter. Install backer rod. Apply primer as required by sealant and EIFS manufacturer. Check that joint width is as shown on drawings but in no case shall it be less than 13 mm for perimeter seals and 20 mm for expansion joints. The width shall not be less than 4 times the anticipated movement. Check sealant manufacturer's recommendations regarding proper width to depth ratio.

3.2.2 Sealant

Apply sealant in accordance with sealant manufacturer's instructions with gun having nozzle that fits joint width. Do not use sealant that has exceeded shelf life or can not be discharged in a continuous flow. Completely fill the joint solidly with sealant without air pockets so that full contact is made with both sides of the joint. Tool sealant with a round instrument that provides a concave profile and a uniformly smooth and wrinkle free sealant surface. Do not wet tool the joint with soap, water, or any other liquid tooling aid. Do not apply sealant until all EIFS coatings are fully dry. During inclement weather, protect the joints until sealant application. Clean all surfaces to remove excess sealant.

3.3 CLEANUP

Upon completion, remove all scaffolding, equipment, materials and debris from site. Remove all temporary protection installed to facilitate installation of EIFS.

-- End of Section --

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DIVISION 07 - THERMAL & MOISTURE PROTECTION

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-- End of Section Table of Contents --

SECTION 07412A

NON-STRUCTURAL METAL ROOFING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 653/A 653M	(2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 209M	(2000) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM D 226	(1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 610	(1995) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(1987; R 1994e1) Evaluating Degree of Blistering of Paints
ASTM D 968	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2244	Test Method for Calculation of Color Differences
ASTM D 2247	(1999) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 4214	(1998) Evaluating Degree of Chalking of Exterior Paint Films
ASTM D 4397	(1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

ASTM D 4587 (1991) Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water- Exposure Apparatus

UNDERWRITERS LABORATORIES (UL)

UL 580 (1994; Rev thru Feb. 1998) Tests for Uplift Resistance of Roof Assemblies

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Metal Roofing; G A/E

a. Drawings consisting of catalog cuts, flashing details, erection drawings, shop coating and finishing specifications, and other data as necessary to clearly describe materials, sizes, layouts, construction details, fasteners, and erection. Drawings shall be provided by the metal roofing manufacturer.

b. Drawings showing the UL 580, Class 1-90 tested roof system assembly.

SD-04 Samples

Accessories; G A/E

One sample of each type of flashing, trim, fascia, closure, cap and similar items. Size shall be sufficient to show construction and configuration.

Roof Panels; G A/E

One piece of each type and finish to be used, 225 mm long, full width.

Fasteners; G A/E

Two samples of each type to be used with statement regarding intended use. If so requested, random samples of screws, bolts, nuts, and washers as delivered to the jobsite shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

Sealant

One sample, approximately 0.5 kg, and descriptive data.

SD-07 Certificates

Roof Panels
Installation
Accessories

Certificates attesting that the panels and accessories conform to the specified requirements. Certificate for the roof assembly shall certify that the assembly complies with the material and fabrication requirements specified and is suitable for the installation at the indicated design slope. Certified laboratory test reports showing that the sheets to be furnished are produced under a continuing quality control program and that at least 3 representative samples of similar material to that which will be provided on this project have been previously tested and have met the quality standards specified for factory color finish.

Installer

Certification of installer.

Warranties

At the completion of the project, signed copies of the 5-year Warranty for Non-Structural Metal Roofing System, a sample copy of which is attached to this section, and the 20-year Manufacturer's Material and Weathertightness Warranties.

SD-10 Operation and Maintenance Data

Maintenance Data

Three copies of maintenance procedures on the roof system and components.

1.3 GENERAL REQUIREMENTS

The Contractor shall furnish a commercially available roofing system which satisfies the specified design and additional requirements contained herein. The roofing system shall be provided by the Contractor as a complete system, as tested and approved in accordance with UL 580. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same roofing system manufacturer.

1.3.1 Non-Structural Metal Roof System

The Non-Structural Metal Roof System covered under this specification shall include the entire roofing system; the metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with UL 580. The system shall be installed on a substrate

specified in Section 07220. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, interior or exterior gutters and downspouts, eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of the specifications that are part of the system.

1.3.2 Manufacturer

The non-structural metal roofing system shall be the product of a manufacturer who has been in the practice of manufacturing metal roofs for a period of not less than 5 years and has been involved in at least five projects similar in size and complexity to this project.

1.3.3 Installer

The installer shall be certified by the metal roof manufacturer to have experience in installing at least three projects that are of comparable size, scope and complexity as this project for the particular roof system furnished. The installer may be either employed by the manufacturer or be an independent installer and have a minimum of 5 years experience.

1.4 DESIGN LOADS

Non-structural Metal Roof System assemblies shall be tested as defined in UL 580 and shall be capable of resisting the wind uplift pressures shown on the contract drawings or, as a minimum, shall be approved to resist wind uplift pressures of UL 580, Class 90.

1.5 PERFORMANCE REQUIREMENTS

The metal roofing system supplied shall conform to the roof slope, the underlayment, and uplift pressures shown on the contract drawings. The Contractor shall furnish a commercially available roofing system which satisfies all the specified requirements.

1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weather tight coverings and kept dry. Material shall not be covered with plastic where such covering will allow sweating and condensation. Plastic may be used as tenting with air circulation allowed. Storage conditions shall provide good air circulation and protection from surface staining.

1.7 WARRANTIES

The Non-Structural Metal Roofing System shall be warranted as outlined below. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

1.7.1 Contractor's Weathertightness Warranty

The Non-Structural Metal Roofing System shall be warranted by the Contractor on a no penal sum basis for a period of five years against material and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The roofing covered under this warranty shall include the entire roofing system, including but not limited to, the roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with UL 580. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, interior or exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of the specifications that are part of the roof system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to service design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's required warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and system manufacturer, which shall be submitted along with Contractor's warranty; however, the Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached WARRANTY FOR NON-STRUCTURAL METAL ROOF SYSTEM, and shall start upon final acceptance of the facility. It is required that the Contractor provide a separate bond in an amount equal to the installed total roofing system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the 5 year Contractor's warranty period for the entire roofing system as outlined above.

1.7.2 Manufacturer's Material Warranties

The Contractor shall furnish, in writing, the following manufacturer's material warranties which cover all Non-Structural Metal Roofing System components such as roof panels, flashing, accessories, and trim, fabricated from coil material:

a. A manufacturer's 20 year material warranty warranting that the aluminum as specified herein will not rupture, fail structurally, or perforate under normal atmospheric conditions at the site. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed coil material.

b. A manufacturer's 20 year exterior material finish warranty warranting that the factory color finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of 8 when measured in accordance with ASTM D 4214; or fade or change colors in excess of 5 NBS units as measured in

accordance with ASTM D 2244. Liability under this warranty is exclusively limited to refinishing or replacing the defective coated coil material.

c. A roofing system manufacturer's 20 year system weathertightness warranty.

1.8 PRE-CONSTRUCTION MEETING

A pre-construction meeting shall be held after product submittals within 60 days after contract award for mutual understanding of the metal roofing system contract requirements. This meeting shall take place at the building site and shall include representatives from the Contractor, the roofing system manufacturer, the roofing supplier, the erector, the designer, and the Contracting Officer. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting.

PART 2 PRODUCTS

2.1 ROOF PANELS

Panels shall be aluminum and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope for slope lengths that do not exceed 9 m. Sheets longer than 9 m may be furnished if approved by the Contracting Officer. Width of sheets shall provide nominal 300 mm of coverage in place. Design provisions shall be made for thermal expansion and contraction consistent with the type of system to be used. All sheets shall be either square-cut or miter-cut. The ridge cap shall be installed as recommended by the metal roofing manufacturer. Height of corrugations, ribs, or seams, at overlap of adjacent roof sheets shall be the manufacturer's standard for the indicated roof slope.

2.1.1 Aluminum Panels

Alloy conforming to ASTM B 209M , temper as required for the forming operation, minimum 0.8 mm thick.

2.2 ACCESSORIES

Accessories shall be compatible with the roofing furnished. Flashing, trim, metal closure strips, caps, and similar metal accessories shall be not less than the minimum thicknesses specified for roof panels. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the panels and shall not absorb or retain water.

2.3 FASTENERS

Fasteners for roof panels shall be zinc-coated steel, aluminum, or nylon capped steel, type and size as recommended by the manufacturer to meet the performance requirements. Fasteners for accessories shall be the

manufacturer's standard. Exposed roof fasteners shall be gasketed or have gasketed washers on the exterior side of the roofing to waterproof the fastener penetration. Washer material shall be compatible with the panels; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 3 mm thick.

2.4 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match Base Standard "GREEN". The exterior coating shall be a nominal 0.050 mm thickness consisting of a topcoat of not less than 0.018 mm dry film thickness and the paint manufacturer's recommended primer of not less than .025 mm thickness. The exterior color finish shall meet the test requirements specified below.

2.4.1 Cyclic Salt Fog/UV Test

A sample of the sheets shall withstand a cyclic corrosion test for a minimum of 2016 hours in accordance with ASTM D 5894, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 10, no blistering, as determined by ASTM D 714; 10, no rusting, as determined by ASTM D 610; and a rating of 6, over 2.0 to 3.0 mm failure at scribe, as determined by ASTM D 1654.

2.4.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 3 mm diameter mandrel, the coating film shall show no evidence of fracturing to the naked eye.

2.4.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM D 4587, test condition B for 2080 total hours. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. For sheets required to have a low gloss finish, the chalk rating shall be not less than No. 6 and the color difference shall be not greater than 7 units.

2.4.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

2.4.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 13 mm diameter hemispherical head indenter, equal to 6.7 times the metal thickness in mm, expressed in N-meters, with no cracking.

2.4.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 50 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

2.4.7 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

2.5 UNDERLAYMENTS

2.5.1 Felt Underlayment

Felt underlayment shall be No. 30 felt in accordance with ASTM D 226, Type II.

2.5.2 Rubberized Underlayment

Rubberized underlayment shall be equal to "Ice and Water Shield" as manufactured by Grace Construction Products, "Winterguard" as manufactured by CertainTeed Corporation, or "Weather Watch Ice and Water Barrier" as manufactured by GAF Building Materials Corporation.

2.5.3 Slip Sheet

Slip Sheet shall be 0.24 kg per square meter rosin sized unsaturated building paper.

2.6 SEALANT

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubberlike consistency. Sealant placed in the roof panel standing seam ribs shall be provided in accordance with the manufacturer's recommendations.

2.7 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be non-running after drying.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated by means of gaskets or insulating compounds. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

3.1.1 Roofing

Side laps shall be laid away from the prevailing winds. Side and end lap distances, joint sealing, and fastening and spacing of fasteners shall be in accordance with manufacturer's standard practice. Spacing of exposed fasteners shall present an orderly appearance. Side laps and end laps of roof panels and joints at accessories shall be sealed. Fasteners shall be driven normal to the surface. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weathertight installation. Accessories shall be fastened into substrate, except as otherwise approved. Closure strips shall be provided as indicated and where necessary to provide weathertight construction.

3.1.2 Underlayment

Underlayment types shall be installed where shown on the drawings; they shall be installed directly over the substrate. If a roof panel rests directly on the underlayments, a slip sheet shall be installed as a top layer, beneath the metal roofing panels, to prevent adhesion. All underlayments shall be installed so that successive strips overlap the next lower strip in shingle fashion. Underlayments shall be installed in accordance with the manufacturer's written instructions. The underlayments shall ensure that any water that penetrates below the metal roofing panels will drain outside of the building envelope.

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOF SYSTEM

FACILITY DESCRIPTION_____

BUILDING NUMBER:_____

CORPS OF ENGINEERS CONTRACT NUMBER:_____

CONTRACTOR

CONTRACTOR:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

OWNER

OWNER:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

CONSTRUCTION AGENT

CONSTRUCTION AGENT:_____

ADDRESS:_____

POINT OF CONTACT:_____

TELEPHONE NUMBER:_____

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOF SYSTEM
(continued)

THE NON-STRUCTURAL METAL ROOF SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY _____ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. THE NON-STRUCTURAL METAL ROOFING SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH UL 580. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHINGS INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE NON-STRUCTURAL METAL ROOFING SYSTEM.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE NON-STRUCTURAL METAL ROOF SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON _____ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

(Company President)

(Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOFING SYSTEM
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE NON-STRUCTURAL METAL ROOFING SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE NON-STRUCTURAL METAL ROOF DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. CONTRACTOR'S DESIGN SHALL INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.
6. THIS WARRANTY APPLIES TO THE NON-STRUCTURAL METAL ROOFING SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

**

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOF SYSTEM
(continued)

**REPORTS OF LEAKS AND ROOF SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS ROOF SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE NON-STRUCTURAL METAL ROOF SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED, THE PARTIES SHALL, WITHIN TEN (10) DAYS, JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN TEN (10) DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE (1) NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED, ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

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DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07413

METAL WALL AND SOFFIT PANELS

10/01

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SECTION 07413

METAL WALL AND SOFFIT PANELS
10/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA Design Manual (2000) Aluminum Design Manual:
Specification & Guidelines for Aluminum
Structures

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mnl (1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 463/A 463M (2000) Steel Sheet, Aluminum-Coated, by
the Hot-Dip Process

ASTM A 653/A 653M (2000) Steel Sheet, Zinc-Coated
(Galvanized) or Zinc-Iron Alloy-Coated
(Galvannealed) by the Hot-Dip Process

ASTM A 792/A 792M (1999) Steel Sheet, 55% Aluminum-Zinc
Alloy-Coated by the Hot-Dip Process

ASTM B 209 (2000) Aluminum and Aluminum-Alloy Sheet
and Plate

ASTM B 209M (2000) Aluminum and Aluminum-Alloy Sheet
and Plate (Metric)

ASTM C 518 (1998) Steady-State Heat Flux Measurements
and Thermal Transmission Properties by
Means of the Heat Flow Meter Apparatus

ASTM D 522 (1993a) Mandrel Bend Test of Attached
Organic Coatings

ASTM D 610 (1995) Evaluating Degree of Rusting on
Painted Steel Surfaces

ASTM D 714 (1987; R 1994e1) Evaluating Degree of
Blistering of Paints

ASTM D 968 (1993) Abrasion Resistance of Organic

Coatings by Falling Abrasive

ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2244	(1995) Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(1999) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993; R 1999e1) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(1997) Measuring Adhesion by Tape Test
ASTM D 4214	(1998) Evaluating Degree of Chalking of Exterior Paint Films
ASTM D 4397	(1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D 5894	(1996) Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
ASTM E 84	(2000a) Surface Burning Characteristics of Building Materials
ASTM E 96	(2000) Water Vapor Transmission of Materials
ASTM G 154	(2000ae1) Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(1998) Minimum Design Loads for Buildings and Other Structures
--------	--

1.2 GENERAL REQUIREMENTS

1.2.1 Design

Criteria, loading combinations, and definitions shall be in accordance with ASCE 7. Maximum calculated fiber stress shall not exceed the allowable value in the AISI or AA manuals; a one third overstress for wind is allowed. Midspan deflection under maximum design loads shall be limited to L/180. Contract drawings show the design wind loads and the extent and general assembly details of the metal panels. Members and connections not shown on the drawings shall be designed by the Contractor. Panels and accessories shall be the products of the same manufacturer. Aluminum panel design shall be in accordance with AA Design Manual.

1.2.2 Architectural Considerations

Panel profile shall be as shown on the drawings.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-02 Shop Drawings

Panels: ~~C-A/E~~

Drawings consisting of catalog cuts, design and erection drawings, shop coating and finishing specifications, and other data as necessary to clearly describe design, materials, sizes, layouts, construction details, fasteners, and erection. Drawings shall be accompanied by engineering design calculations for the panels.

SD-04 Samples

Accessories: ~~C-A/E~~

One sample of each type of flashing, trim, closure, cap and similar items. Size shall be sufficient to show construction and configuration.

Panels: ~~C-A/E~~

One piece of each type and finish (exterior and interior) to be used, 225 mm long, full width.

Fasteners: ~~C-A/E~~

Two samples of each type to be used with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to the jobsite shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

Sealant: ~~C-A/E~~

One sample, approximately 0.5 kg, and descriptive data.

SD-07 Certificates

Panels: ~~C-A/E~~

Installation: ~~C-A/E~~

Certificates attesting that the panels and accessories conform to the requirements specified. Certified laboratory test reports showing that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than 5 pieces has been tested and

has met the quality standards specified for factory color finish.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage accommodations for metal panels shall provide good air circulation and protection from surface staining. Protect strippable protective covering on metal panels from exposure to sunlight and high humidity, except to extent necessary for period of panel installation.

1.5 WARRANTIES

The Contractor shall provide a weather tight warranty for the metal panels for a period of 20 years to include panel assembly, 10 years against the wear of color finish, and 10 years against the corrosion of fasteners caused by ordinary wear and tear by the elements. The warranties shall start upon final acceptance of the work or the date the Government takes possession, whichever is earlier.

PART 2 PRODUCTS

2.1 PANELS

Provide factory-formed and -assembled metal-faced composite panels fabricated from two metal facings bonded, using no glues or adhesives, to solid extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for weathertight system. Panels shall have a factory color finish.

2.1.1 Fire-Retardant Core

Noncombustible, with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

- a. Flame-Spread Index: 15 or less.
- b. Smoke-Developed Index: 105 or less.

2.1.2 Aluminum-Faced Composite Panels

Alloy conforming to ASTM B 209M , temper as required for the forming operation. Formed with 0.50 mm thick, coil-coated aluminum sheet facings. Panels shall be 6 mm thick.

2.2 Panel Fabrication

Fabricate and finish metal panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle. Fabricate metal panels with panel stiffeners as required to maintain fabrication tolerances and to withstand design loads.

Fabricate metal panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight

seals.

Provide factory cutouts for building accessories such as light fixtures, sprinkler heads, and mechanical grilles.

2.3 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated in Section 09915 COLOR SCHEDULE. The exterior coating shall consist of a topcoat and the paint manufacturer's recommended primer. The interior color finish shall consist of a nominal 0.025 mm thick PVF2 finish otherwise the same as the exterior. The exterior color finish shall meet the test requirements specified below.

2.3.1 Salt Spray Test

A sample of the sheets shall withstand a cyclic corrosion test for a minimum of 2016 hours in accordance with ASTM D 5894, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 10, no blistering, as determined by ASTM D 714; 10, no rusting, as determined by ASTM D 610; and a rating of 6, 2.0 to 3.0 mm failure at scribe, as determined by ASTM D 1654.

2.3.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 3 mm diameter mandrel, the coating film shall show no evidence of fracturing to the naked eye.

2.3.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM G 154. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating with an adhesion rating of less than 4B when tested in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. For sheets required to have a low gloss finish, the chalk rating shall be not less than No. 6 and the color difference shall be not greater than 7 units.

2.3.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

2.3.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 13 mm diameter hemispherical head indenter, equal to 6.7 times the metal thickness in mm, expressed in Newton-meters, with no loss of adhesion.

2.3.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 50 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

2.4 ACCESSORIES

Flashing, trim, metal closure strips, caps, and similar metal accessories shall be the manufacturer's standard products. Exposed metal accessories shall be finished to match the panels furnished.

2.5 FASTENERS

Fasteners for aluminum panels shall be aluminum or corrosion resisting steel. Fasteners for attaching panels to supports shall provide both tensile and shear strength of not less than 3340 N per fastener. Fasteners for accessories shall be the manufacturer's standard. Nonpenetrating fastener system for wall panels using concealed clips shall be manufacturer's standard for the system provided.

2.5.1 Screws

Screws shall be as recommended by the manufacturer.

2.5.2 Blind Rivets

Blind rivets shall be aluminum with 5 mm nominal diameter shank or stainless steel with 3 mm nominal diameter shank. Rivets shall be threaded stem type if used for other than the fastening of trim. Rivets with hollow stems shall have closed ends.

2.5.3 Bolts

Bolts shall be not less than 6 mm diameter, shouldered or plain shank as required, with proper nuts.

2.6 SEALANT

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the metal panels and shall cure to a rubberlike consistency.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

3.1.1 Wall Panels and Accessories

Panels shall be applied in the configuration shown on the approved shop drawings. Accessories shall be fastened into framing members, except as otherwise approved. Closure strips shall be provided as indicated and where necessary to provide weathertight construction.

Install attachment system required to support wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

3.1.1.1 Concealed Fastener Wall Panels

Panels shall be fastened to framing members with concealed fastening clips or other concealed devices standard with the manufacturer. Spacing of fastening clips and fasteners shall be in accordance with the manufacturer's written instructions. Spacing of fasteners and anchor clips along the panel interlocking ribs shall not exceed 300 mm on center except when otherwise approved. Fasteners shall not puncture metal sheets except as approved for flashing, closures, and trim; exposed fasteners shall be installed in straight lines. Joints at accessories shall be sealed.

3.1.2 Cleaning and Protection

Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

-- End of Section --

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DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07510A

BUILT-UP ROOFING

08/96

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-- End of Section Table of Contents --

SECTION 07510A

BUILT-UP ROOFING

08/96

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 41	(1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 43	(1994) Coal Tar Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 226	(1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 227	(1998) Coal-Tar Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 312	(1995a) Asphalt Used in Roofing
ASTM D 450	(1996) Coal-Tar Pitch Used in Roofing, Dampproofing, and Waterproofing
ASTM D 1668	(1997a) Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
ASTM D 1863	(1993; R 1996) Mineral Aggregate Used on Built-Up Roofs
ASTM D 2178	(1997) Asphalt Glass Felt Used in Roofing and Waterproofing
ASTM D 2626	(1997b) Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing
ASTM D 3617	(1983; R 1994) Sampling and Analysis of New Built-Up Roof Membranes
ASTM D 3909	(1997) Asphalt Roll Roofing (Glass Felt) Surfaced With Mineral Granules
ASTM D 4022	(1994) Coal Tar Roof Cement, Asbestos Containing
ASTM D 4586	(1993) Asphalt Roof Cement, Asbestos Free

ASTM D 4601

(1998) Asphalt-Coated Glass Fiber Base
Sheet Used in Roofing

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825c

(1998) Approval Guide Building Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-03 Product Data

Inspection; G ~~REA~~/E

The inspection procedure for roofing installation, prior to the start of roofing work.

SD-07 Certificates

Bitumen
Felt

Certificates of Compliance for felts and bitumens.

Cants

Certificate attesting that the fiberboard furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

SD-10 Operation and Maintenance Data

1.3 STORAGE OF MATERIALS

Felts, fabrics, and roll roofing shall be kept dry before, during, and after delivery to the site and shall be stored in an enclosed building or in a closed trailer, and stored on end 1 level high. Felt rolls shall be maintained at a temperature above 10 degrees C for 24 hours immediately before laying. Aggregate shall be kept dry as defined by ASTM D 1863.

1.4 WARRANTY

Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

- a. Warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, cover boards, substrate board, roof pavers, walkway products, and other components of roofing system.
- b. Warranty Period: 25 years from date of Substantial Completion.

- c. Submit roofing Installer's warranty, signed by Installer, covering Work of this Section, including all components of roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, roof pavers, and walkway products, for a warranty period of 2 years, from date of Substantial Completion.

PART 2 PRODUCTS

2.1 COAL-TAR BITUMEN PRIMER

ASTM D 43 for coal-tar roofing systems.

2.2 BITUMEN

2.2.1 Asphalt

Used for adhering insulation and flashings.

ASTM D 312, Type III on slopes from 21 mm per m up to and including 250 mm per m; or Type IV on slopes above 250 mm per m. Bills of lading shall indicate the flash point and equiviscous temperature (EVT) or this information shall be shown on labels for each container of asphalt.

2.2.2 Coal-Tar Bitumen

ASTM D 450, Type III, for 21 mm per m slope as an option to asphalt.

2.3 BITUMINOUS CEMENT

ASTM D 4586 for use with asphalt roofing systems. ASTM D 4022 for use with coal-tar roofing systems; preference shall be given to cements whose mineral fillers exclude asbestos fibers.

2.4 CANTS

Cants shall be made from treated wood or treated fiberboard not less than 89 mm high cut to reduce change in direction of the membrane to 45 degrees or less. Treated wood shall be of water-borne preservative-treated material as specified in Section 06114 "Wood Blocking and Curbing." Fiberboard shall contain the highest practicable percentage of materials which have been recovered or diverted from solid waste (e.g., post-consumer waste), but not including material reused in a manufacturing process. Where two materials have comparable price and performance, the one having the higher recovered material content shall be selected. Fiberboard shall conform to ASTM C 208 with a minimum recovered material content of 80 percent, treated with sizing, wax or bituminous impregnation.

2.5 FELT

2.5.1 Base Sheet

Base sheet shall conform to ASTM D 4601, Type II, with no perforations.

2.5.2 Organic Felt Base

ASTM D 2626 for use with asphalt roofing system.

2.5.3 Organic Felt

ASTM D 226 for use with asphalt roofing system and ASTM D 227 for use with coal-tar roofing system. Organic felts may be used for bitumen stops, and edge envelopes.

2.6 MODIFIED BITUMEN UNDERLAYMENT

Membrane Sheet: ASTM D 4601, Type II, SBS-modified asphalt-impregnated and -coated sheet, with glass-fiber-reinforcing mat, dusted with fine mineral surfacing on both sides.

2.7 NAILS AND FASTENERS

Nails and fasteners shall be an approved type recommended by the roofing felt manufacturer. Fasteners for steel or concrete deck shall conform to FM P7825c for Class I roof deck construction, to withstand an uplift pressure of 440 kg per square meter.

2.8 AGGREGATE SURFACING MATERIALS

Crushed stone, gravel, or crushed slag conforming to ASTM D 1863 (size 6/7). Subject to approval, other materials may be used when blended to the grading requirements of ASTM D 1863. Aggregate shall be light-colored and opaque.

2.9 WALKWAY SURFACES

2.9.1 Mineral Asphalt Plank

ASTM D 517, minimum 19.1 mm thick.

2.9.2 Concrete Slab

Precast Concrete walk pads 20.7 MPa, 600 x 600 x 63 mm.

2.9.3 Interlocking Rubber Pavers

610 mm x 610 mm x 57 mm pavers weighing approximately 30 kg/sq m, interlocked together with aluminum paver keys. Pavers shall provide multi-directional drainage capability. Color shall be as selected from manufacturer's standard colors.

2.10 WOVEN GLASS FABRIC

ASTM D 1668, Type II for coal-tar roofing systems.

2.11 INSULATION

Insulation shall be fiberboard, composite board or polyisocyanurate, as specified in Section 07220 ROOF INSULATION. Top layer shall be minimum 19 mm thick fiberboard.

2.12 FLASHINGS

Bituminous flashings in accordance with these specifications shall be used throughout unless otherwise specified or indicated.

PART 3 EXECUTION

3.1 COORDINATION

The entire roofing system, excluding flood coat and aggregate surfacing, shall be finished in one operation up to the line of termination at end of day's work. Glaze coating may be considered part of the flood coat as specified in paragraph GLAZE COAT. Phased construction will not be permitted.

3.1.1 Insulation

Application of roofing shall immediately follow application of insulation as a continuous operation. Roofing operations shall be coordinated with insulation work so that all roof insulation applied each day is waterproofed the same day. Insulation is specified in Section 07220 ROOF INSULATION.

3.1.2 Sheet Metalwork

Roofing operations shall be coordinated with sheet metalwork so that sheet metal items are installed to permit continuous roof surfacing operations the same day felts are installed. Sheet metalwork is specified in Section 07600.

3.2 ENVIRONMENTAL CONDITIONS

Air temperature shall be above 4 degrees C and there shall be no visible ice, frost, or moisture on the roof deck at the time roofing is installed.

3.3 PREPARATION REQUIREMENTS

The substrate construction of a bay or section of the building shall be completed before roofing work is begun thereon. Roofing applied directly on concrete shall not be scheduled until frothing or bubbling does not occur when hot bitumen is applied to the concrete and until the hot bitumen sticks tightly to the concrete. Vents and other items penetrating the roof shall be secured in position and properly prepared for flashing. Nailers, curbs and other items attached to roof surface shall be in place before roofing is begun.

3.4 INSTALLATION OF CANTS

Cants shall be installed in the angles formed between the roof and walls or other vertical surfaces. Cants shall be laid in a solid coat of bituminous cement just prior to laying the roofing plies. Cants shall be continuous, and shall be installed in lengths as long as practicable. Additional cants are not required at locations where cast-in-place cants are integrally formed with the structural deck or roof fill.

3.5 CONDITION OF SURFACES

Surfaces shall be inspected and approved immediately before application of roofing and flashings. The roofing and flashings shall be applied to a smooth and firm surface free from ice, frost, visible moisture, dirt, projections, and foreign materials. Prior to application of primer on precast concrete decks, joints shall be covered with a 100 mm strip of roofing felt, embedded in and coated with bituminous cement.

3.6 MECHANICAL APPLICATION DEVICES

Mechanical application devices shall be mounted on pneumatic-tired wheels, and shall be designed and maintained to operate without damaging the insulation, roofing membrane, or structural components.

3.7 HEATING OF BITUMEN

Asphalt shall not be heated higher than 24 degrees C above the EVT or 10 degrees C below the flash point or 274 degrees C (maximum) whichever is lower. EVT and flash point temperatures of asphalt in the kettle shall be conspicuously posted on the kettle. Coal tar bitumen shall not be heated above 218 degrees C. as recommended by the roofing manufacturer. Heating kettles shall be provided with automatic thermostatic controls and an accurate thermometer. Kettle operators shall be in attendance at all times during the heating to ensure that the maximum temperature specified is not exceeded. Equipment utilizing flame-heat shall not be placed on the roof.

3.8 BITUMEN STOPS

Bitumen stops shall be installed at roof edges, openings and vertical projections before application of roofing plies unless otherwise recommended by the manufacturer's printed instructions. Bitumen stops shall be formed of two 450 mm wide strips of organic felt. Two hundred twenty five millimeters of the width shall be attached to the roof surface with 225 mm extending beyond the edge. The first strip shall be applied in a 225 mm wide layer of bituminous roofing cement and nailed 13 mm from the roof edge. The second strip shall be applied to the first in a 225 mm wide mopping of bitumen. The free portion of each strip shall be protected from damage throughout the roofing period. After the roofing plies are in place, the free portion of each strip shall be folded back over the roofing membrane and embedded in a continuous coating of bituminous cement.

3.9 BITUMEN APPLICATION

Asphalt shall be applied within a range of 14 degrees C below to 14 degrees C above the EVT. Temperature of coal-tar bitumen at the time it is applied shall be in accordance with the bitumen manufacturer's recommendations. Application temperatures shall be measured at the mop bucket or mechanical applicator. Bitumen at a temperature below the recommended temperature shall be returned to the kettle. Each layer of felt shall be laid in not less than 1.4 kg nor more than 1.7 kg of coal-tar bitumen per square meter.

Where solid moppings are required, the following requirements as evidenced in any one roof cut-out sample shall apply:

- a. Overlapping voids between two or more plies are not acceptable.
- b. The maximum length of any individual void that is encapsulated in bitumen shall be 50 mm.
- c. The total length of all voids encapsulated in bitumen shall not exceed 100 mm between any two plies.
- d. Dry voids (the absence of bitumen between plies) are not acceptable.
- e. Voids continuous through the specimen are not acceptable.
- f. Visual interply moisture in voids is not acceptable.

3.10 APPLICATION OF FELTS

Felt plies shall be laid at right angles to the slope of the deck with minimum 150 mm end-laps staggered at least 300 mm. Felts shall be applied in 900 mm widths with 24 17 mm side laps and starter sheets 300, 600 and 900 mm wide along eaves to maintain 4 full plies including the base sheet when used. The full 900 mm width of each ply shall be placed in hot bitumen immediately behind the applicator. A broom shall be used to eliminate air pockets and obtain complete adhesion between plies. Bitumen shall be visible beyond all edges of each ply as it is being installed. Plies shall be laid free of wrinkles, creases or fishmouths. Each layer of roofing felt shall be carried up to the top of the cant. Workers shall not walk on mopped surfaces when the bitumen is fluid.

3.10.1 On Concrete or Insulation Surfaces

Four plies of 900 mm wide glass roofing felts shall be placed shingle-fashion in solid mopped bitumen.

3.11 PROTECTION OF APPLIED ROOFING

At end of day's work or whenever precipitation is imminent, the terminated edge of built-up roofing shall be sealed with 2 full width strips of roofing felt set in and coated with bituminous cement. One half-width of the strips shall be extended up and over the finished roofing and the other half-width extended out and onto the bare roof deck. Sealing strips shall be removed before continuing installation of roofing. To facilitate sealing, termination edges may be straightened with pieces of insulation board which shall be removed when work is resumed.

3.12 FLASHINGS

Flashings shall be provided over cants in the angles formed at walls and other vertical surfaces and where required to make the work watertight. Bituminous flashings described below shall be used, except where metal flashings are specified in other sections of the specifications. Flashings shall be provided and installed immediately after the top ply of felt is placed and before the flood coat and aggregate are placed, adjacent to the flashing. Modified bituminous flashing may be used when it is specified in the roofing manufacturer's instructions.

3.12.1 Base Flashings

Base Flashings shall be a 3-ply system using woven glass fabric, laid in roofing cement, with mineral surfaced roll roofing as the outer ply. The top of the base flashing shall be at least 200 mm above the roof membrane surface. Mineral surfaced roofing strips shall be cut from the width of the rolls, and shall extend from the reglet or top of curb onto the roof at least 50 mm beyond the widest flashing ply. Laps shall be well cemented, and where possible, shall be shingled in a direction down slope or away from the prevailing wind. The top edge of base flashing systems shall be nailed a maximum of 200 mm on center.

3.12.2 Strip Flashings

Sheet metal flashings, bitumen stops and gravel stops installed over the roofing top ply shall be strip flashed with 2 layers of roofing felt, 225 mm and 300 mm wide and successively cemented in place.

3.12.3 Valleys and Ridges

Felt plies shall continue across valleys and ridges and terminate approximately 300 mm from the valley or ridge. Exposed lap shall terminate on a line approximately 300 mm from, and parallel to the valley or ridge. Two plies of roofing felt 225 mm wide bottom ply, and 300 mm wide top ply, shall be successively mopped-in over each felt line of termination.

3.13 WALKWAYS

Walkways shall be mineral-surfaced asphalt planks, and embedded in a second flood coat over a double layer of aggregate surfacing and concrete slabs, and shall be located as indicated. Interlocking rubber pavers shall be installed at locations shown in accordance with manufacturer's instructions.

3.14 AGGREGATE SURFACING

After roofing felts have been laid and flashings installed, the roof surface, except for cants, shall be flood-coated uniformly with 3.5 kg per square meter of coal-tar bitumen if coal-tar roof system is used. Aggregate surfacing materials shall be spread on the hot bitumen at a rate of 19.5 kg per square meter for gravel.

3.15 GLAZE COAT

Glaze coating shall be used to waterproof completed sections when more than one day is required to finish the roofing. If there is a probability of rain falling on the felts before the flood coat and aggregate can be applied, a light glaze coat of bitumen 0.49 kg to 0.73 kg per square meter, shall be applied over the exposed felts. The surfacing operation shall be completed within 48 hours after application of the glaze coat. Where glaze coat is used, surface treatment shall be completed as soon as weather conditions permit.

3.16 ROOF CUT-OUT TESTS

Roof cut-out samples shall be taken and analyzed in accordance with ASTM D 3617 as directed by the Contracting Officer when there is reason to believe that deficiencies exist in the roofing membrane. When samples indicate deficiencies in the built-up roofing, corrective action shall be taken as directed.

3.17 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roofing with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Inspection shall include, but not be limited to, the following:

- a. Environmental conditions; number and skill level of roofing workers; start and end time of various tasks; condition of substrate.
- b. Verification of compliance of materials before, during, and after installation.
- c. Inspection of condition of equipment and accuracy of thermometers and metering devices.

- d. Inspection of flashings, cants and curbs.
- e. Inspection of membrane placement, including edge envelopes, widths of starter sheets, laps, proper use of squeegee, and mechanical fastening.
- f. Inspection of application of bitumen, aggregate, and walkways.
- g. Inspection of embedment of aggregate for required weight and coverage.
- h. Cutout sampling and analysis as directed.

-- End of Section --

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SECTION 07530

ELASTOMERIC ROOFING (EPDM)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29/C 29M	(1997) Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM D 448	(1986; R 1993) Sizes of Aggregate for Road and Bridge Construction
ASTM D 4637	(1996) EPDM Sheet Used in Single-Ply Roof Membrane
ASTM E 108	(1996) Fire Tests of Roof Coverings

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P9513	(1996) Loss Prevention Data for Roofing Contractors
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SINGLE PLY ROOFING INSTITUTE (SPRI)

SPRI RP-4	(1997) Wind Design Standard for Ballasted Single-Ply Roofing Systems
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UNDERWRITERS LABORATORIES (UL)

UL 580	(1994; Rev thru Feb 1998) Tests for Uplift Resistance of Roof Assemblies
UL 790	(1997; Rev thru Jul 1998) Tests for Fire Resistance of Roof Covering Materials
UL 1256	(1998) Fire Test of Roof Deck Constructions

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-02 Shop Drawings

Roofing System; G REA/E

Drawings showing size of sheets, position of sheets and splices, flashing details, fastening patterns where applicable for insulation and membrane sheets, and expansion joint details. Detail showing construction of water cutoffs to be used at membrane terminations at the end of a day's work to seal the roofing system from water intrusion.

SD-03 Product Data

Installation; G REA/E

Manufacturer's instructions for preparing and installing the membrane, flashings, seams, insulation, nailers and other accessories.

Protection of Finished Roofing; G REA/E

Protection plan showing areas to be protected, type of material used; a plan to protect the membrane from damage until completion of work by other trades, and a description of the method of repairing the roofing.

Inspection; G REA/E

The inspection procedure for substrate suitability including decks, curbs and insulation installation, prior to start of the work. Inspection procedures during and after placement of the membrane, and after completion of work by other trades.

SD-07 Certificates

Materials

Certificates of compliance attesting that the roofing system and materials meet specification requirements. The certificates shall list the components required for the specified fire and wind uplift resistance ratings.

Certificates stating Roofing Contractor has minimum five years experience installing roof systems of similar construction.

SD-10 Operation and Maintenance Data

Maintenance recommendations for the roofing system.

1.3 GENERAL REQUIREMENTS

Elastomeric membrane roofing shall be fully adhered to the roof surfaces indicated. Roofing membrane sheet widths shall be consistent with membrane attachment methods and wind uplift requirements, and shall be as large as practical to minimize joints. Membrane shall be free of defects and foreign material. Flashing work shall be coordinated to permit continuous membrane installation operations. Applied insulation shall be weatherproofed by the membrane on the same day.

1.3.1 Delivery and Storage

Materials shall be delivered to the jobsite in the manufacturer's original, unopened packages, clearly marked with the manufacturer's name, brand name, and description of contents. Materials shall be stored in clean, dry areas. Storage temperatures shall be as specified by the manufacturer. Materials stored on the roof shall not exceed five day's supply and shall be distributed so as not to exceed the roof live load capacity.

1.3.2 Fire Resistance

The completed roof system shall have a Class A classification, and meet fire test requirements of FM P9513, Appendix B for roof deck construction. Compliance of each component of the roofing system shall be evidenced by label or by written certification from the manufacturer.

1.3.3 Wind Uplift Requirements

Fully adhered roofing system shall have an FM 1-90 Rating or FM P9513, Appendix C Windstorm Classification. Ratings from other independent laboratories may be substituted provided that the tests, requirements and ratings are documented to be equivalent, to the satisfaction of the Contracting Officer. .

1.3.4 Warranty

Manufacturer's standard warranty for the roofing system shall be provided for not less than 10 years from acceptance of the work. Warranty shall state that manufacturer shall repair or replace defective materials if the roofing system leaks or allows the insulation beneath the membrane to become wet during the period of the warranty.

PART 2 PRODUCTS

2.1 ADHESIVES

Adhesives, splicing cements, solvents, and sealants shall be as recommended by the membrane manufacturer.

2.2 FASTENERS

Fasteners for sheet-metal flashing shall be corrosion resistant steel annular-type nails or screws. Fasteners for anchoring the roofing membrane shall be as approved by the membrane manufacturer and identical to those used to obtain the wind uplift rating.

2.3 MEMBRANE

Membrane shall conform to ASTM D 4637, Type I, reinforced EPDM, Grade 1; Class U, 1.52 mm minimum thickness .

2.4 PREFABRICATED ACCESSORIES

Pipe seals and expansion joint covers shall be types and sizes recommended by the membrane manufacturer.

PART 3 EXECUTION

3.1 ENVIRONMENTAL CONDITIONS

Membrane shall not be installed in high wind, inclement weather or when

there is visible ice, frost or moisture on the deck, insulation or membrane. Membrane shall not be installed when ambient air temperature is below 4 degrees C or the minimum specified by the membrane manufacturer.

3.2 PREPARATION

The substrate of any bay or section of the building shall be complete and suitable for insulation and membrane installation before roofing is begun. Insulation over which elastomeric roofing is installed shall conform to Section 07220 ROOF INSULATION. Surfaces against which membrane is applied shall be smooth, clean, and free from dirt, water, dew, oil, grease, sharp edges and construction debris; all joints over 6 mm wide shall be sealed; joints over 13 mm between insulation boards shall be filled with the same insulation. Wood nailers shall comply with Section 06114 WOOD BLOCKING AND CURBING.

3.3 INSTALLATION

Installation shall comply with the manufacturer's approved instructions, except as otherwise specified.

3.3.1 Flashing

Edges of membrane, projections through the roof and changes in roof planes shall be flashed. The flashing material shall be extended and sealed a minimum of 75 mm on each side of the fasteners which attach the membrane to nailers. The installed flashing shall be fastened at the top of the flashing a maximum of 300 mm on center under metal counter-flashing or cap.

3.3.2 Expansion Joints

Expansion joints shall be covered using prefabricated covers or elastomeric flashing in accordance with the manufacturer's recommendations.

3.3.3 Membrane Installation

Membrane shall be applied in accordance with the manufacturer's instructions and the following requirements. Adjoining sheets comprising the membrane shall be adhered one to another using a butyl-based contact adhesive. Minimum width of the laps shall be 100 mm. A primer shall be used before applying the contact adhesive if required by the membrane manufacturer. In applying the contact adhesive, the minimum thickness of the wet film shall be in accordance with the membrane manufacturer's recommendations. If manufacturer's recommendations are not available, the minimum thickness shall be 0.6 mm. A wet film thickness gage shall be used to determine wet film thickness. Direction of lap shall be such that water flows over lap. Membrane joints shall be free of wrinkles or fishmouths. Before application of the contact adhesive, the rubber surfaces to be mated shall be well cleaned. Joints shall be inspected over entire length after completion and defective areas shall be resealed and patched. Damaged areas of membrane shall be removed and replaced with new materials, lapping underlying membrane by at least 100 mm on all sides.

After installation of membrane lap, install a 75 mm wide seam tape along the entire length of membrane lap or manufacturer's recommendations. Roll the seam tape to ensure proper adhesion with hand roller across the width and along the entire length of the seam. After installation of the seam tape, install manufacturer's lap sealant to entire seam edge per manufacturer's requirements.

3.3.4 Cutoffs

Cutoffs shall be installed if work day is ended or interrupted by bad weather before roof section is complete. The insulation line shall be straightened using loose-laid cut insulation and the membrane shall be sealed to the roof deck. Flutes in metal decking shall be sealed off along the cutoff edge. Membrane shall be pulled free or cut to expose the insulation when resuming work, and cut insulation sheets used for fill-in shall be removed as necessary to maintain the staggered pattern.

3.4 PROTECTION OF FINISHED ROOFING

The roofing membrane shall be protected from damage by other trades. After completion of work by other trades, the protection shall be removed and the roof shall be inspected. Any damage shall be repaired in accordance with the recommendations of the roofing manufacturer.

3.5 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed elastomeric roofing with the contract requirements. The procedure shall include a checklist of points to be observed. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of roofing workers; start and end time of various tasks; condition of substrate.
- b. Verification of compliance of materials before, during and after installation.
- c. Inspection of insulation, nailers, flashings, penetrations and work requiring coordination with roofing.
- d. Inspection of membrane placement, splicing, and attachment.

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SECTION 07600

FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM B 32	(1996) Solder Metal
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(1995) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM D 543	(1995) Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D 822	(1996) Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Exposure Apparatus
ASTM D 828	(1997) Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation-Apparatus
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2822	(1991; R 1997e1) Asphalt Roof Cement

ASTM D 3656	(1997) Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
ASTM D 4022	(1994) Coal Tar Roof Cement, Asbestos Containing
ASTM D 4586	(1993) Asphalt Roof Cement, Asbestos Free
ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM A 653/A 653 M	(1997) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 69	(1995; Rev. A) Rolled Zinc
ASTM D41	(1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

SHEET METAL & AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION
(SMACNA)

SMACNA Architectural Manual	(1993; Errata; Addenda Oct. 1997) Architectural Sheet Metal Manual
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1.2 GENERAL REQUIREMENTS

Sheet metalwork shall be accomplished to form weathertight construction without waves, warps, buckles, fastening stresses or distortion, and shall allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed by sheet metal mechanics. Application of bituminous strip flashing over various sheet metal items is covered in Section 07510 BUILT-UP ROOFING. Installation of sheet metal items used in conjunction with roofing shall be coordinated with roofing work to permit continuous roofing operations. Sheet metalwork pertaining to heating, ventilating, and air conditioning is specified in Division 15.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-02 Shop Drawings

Materials; ~~C-A/E~~

Drawings of sheet metal items showing weights, gauges or thicknesses; types of materials; expansion-joint spacing; fabrication details; and installation procedures.

A. Covering on flat, sloped, or curved surfaces

B. Gutters

- C. Downspouts
- D. Expansion joints
- E. Gravel stops and fascias
- F. Base flashing
- G. Counterflashing
- H. Flashing at roof penetrations
- I. Scuppers and collector boxes
- J. Open valley flashing
- K. Eave flashing
- L. Copings

SD-10 Operation and Maintenance Data

Pre-finished metal copings, downspouts, and gutters

Submit recommended maintenance and cleaning procedures.

1.4 WARRANTY

Manufacturer's standard form in which manufacturer agrees to repair finish or replace pre-finished sheet metal products that show evidence of deterioration of factory-applied finishes within specified warranty period.

Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
- b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
- d. Finish Warranty Period: 20 years from date of Substantial Completion.

Installer's warranty, signed by Installer, in which Installer agrees to repair or replace components of custom-fabricated flashing and sheet metal that fail in materials or workmanship within 2 years from date of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, and wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage. Materials shall be stored in dry, ventilated areas until immediately before installation.

PART 2 PRODUCTS

2.1 MATERIALS

Lead, lead-coated metal, and galvanized steel shall not be used. Any metal listed by SMACNA Architectural Manual for a particular item may be used, unless otherwise specified or indicated. Materials shall conform to the requirements specified below and to the thicknesses and configurations established in SMACNA Architectural Manual. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items shall be copper.

2.1.1 Accessories

Accessories and other items essential to complete the sheet metal installation, though not specifically indicated or specified, shall be provided.

2.1.2 Aluminum Extrusions

ASTM B 221M , Alloy 6063, Temper T5.

2.1.3 Bituminous Cement

Type I asphalt cement conforming to ASTM D 2822 or ASTM D 4586. For coal tar roofing; coal tar cement conforming to ASTM D 4022.

2.1.4 Sealant

Unless otherwise specified, sealant shall be an elastomeric weather resistant sealant as specified in Section 07900 JOINT SEALING.

2.1.5 Fasteners

Fasteners shall be compatible with the fastened material and shall be the type best suited for the application.

2.1.6 Felt

ASTM D 226, Type I.

2.1.7 PVC Control Joint Gaskets for Expansion Joints

2.1.8 Copper

ASTM B 370, Temper H 00.

2.1.9 Stainless Steel

ASTM A 167, Type 302 or 304; fully annealed, dead soft temper.

2.1.10 Solder

ASTM B 32, 95-5 tin-antimony.

2.1.11 Through-Wall Flashing

- a. Copper laminated on both sides, with a treated glass fabric, not less than 0.14 kg, factory coated both sides with acid- and alkali-resistant bituminous compound not less than 1.8 kg per

square meter. Use stainless steel drip edge with hemmed edge.

- b. Stainless steel, Type 304, not less than 0.08 mm thick, completely encased by and permanently bonded on both sides to 23 kg high strength bituminized crepe kraft paper, using hot asphalt, heat, and pressure.

2.1.12 Louver Screen

Type III aluminum alloy insect screening conforming to ISWA IWS 089 or Plastic-coated glass fiber mesh conforming to ASTM D 3656.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Gutters and downspouts shall be designed and fabricated in conformance with SMACNA Architectural Manual; louvers shall be fabricated in conformance with SMACNA Arch. Manual and as indicated. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 13 mm hem on the concealed side, and bottom edges of exposed vertical surfaces shall be angled to form drips. Bituminous cement shall not be placed in contact with roofing membranes other than built-up roofing.

3.2 EXPANSION JOINTS

Expansion joints shall be provided as specified in SMACNA Architectural Manual. Expansion joints in continuous sheet metal shall be provided at 12.0 meter intervals for copper and stainless steel and at 9.6 meter intervals for aluminum, except extruded aluminum gravel stops and fascias which shall have expansion joints at not more than 3.6 meter spacing. Joints shall be evenly spaced. An additional joint shall be provided where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing.

3.3 PROTECTION FROM CONTACT WITH DISSIMILAR MATERIALS

3.3.1 Aluminum

Aluminum surfaces shall not directly contact other metals except stainless steel, zinc, or zinc coating. Where aluminum contacts another metal, paint the dissimilar metal with a primer followed by two coats of aluminum paint.

Where drainage from a dissimilar metal passes over aluminum, paint the dissimilar metal with a pigmented paint.

3.3.2 Metal Surfaces

Paint surfaces in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

3.3.2.1 Paint

Use all Kynar prefinished metals.

3.3.3 Wood or Other Absorptive Materials

Paint surfaces, that may become repeatedly wet and in contact with metal, with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

3.3.4 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and cemented to the aluminum surface using a cement compatible with aluminum.

3.4 CONNECTIONS AND JOINTING

3.4.1 Soldering

Soldering shall apply to copper, and stainless steel items. Edges of sheet metal shall be pretinned before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam. Edges of stainless steel to be pretinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering, the acid flux residue shall be thoroughly cleaned from the sheet metal with a water solution of washing soda and rinsed with clean water. Do not solder aluminum.

3.4.2 Riveting

Joints in aluminum sheets 1.0 mm or less in thickness shall be mechanically made.

3.4.3 Seaming

Flat-lock and soldered-lap seams shall finish not less than 25 mm wide. Unsoldered plain-lap seams shall lap not less than 75 mm unless otherwise specified. Flat seams shall be made in the direction of the flow.

3.5 CLEATS

A continuous cleat shall be provided where indicated or specified to secure loose edges of the sheet metalwork. Butt joints of cleats shall be spaced approximately 3 mm apart. The cleat shall be fastened to supporting wood construction with nails evenly spaced not over 300 mm on centers. Where the fastening is to be made to concrete or masonry, screws shall be used and shall be driven in expansion shields set in concrete or masonry.

3.6 GUTTERS AND DOWNSPOUTS

Gutters and downspouts shall be installed as indicated. Gutters shall be supported by continuous cleats. Downspouts shall be rigidly attached to the building. Supports for downspouts shall be spaced according to manufacturer's recommendations.

3.6.1 Terminations

Provide downspouts terminating in splash blocks with elbow-type fittings, or terminating in pipe boot as specified in Section 02630.

3.7 FLASHINGS

Flashings shall be installed at locations indicated and as specified below.

Sealing shall be according to the flashing manufacturer's recommendations.

Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, except that flashing for heating and plumbing, including piping, roof, and floor drains, and for electrical

conduit projections through roof or walls are specified in other sections. Except as otherwise indicated, counter flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be covered up by an application of bituminous plastic cement at the perforation. Flashing shall be installed on top of joint reinforcement. Flashing shall be formed to direct water to the outside of the system.

3.7.1 Base Flashing

Metal base flashing shall be coordinated with roofing work. Metal base flashing shall be set in plastic bituminous cement over the roofing membrane, nailed to nailing strip, and secured in place on the roof side with nails spaced not more than 75 mm on centers. Metal base flashing shall not be used on built-up roofing.

3.7.2 Counter Flashings

Except as otherwise indicated, counter flashings shall be provided over base flashings. Counter flashing shall be installed as shown on the drawings and in SMACNA Architectural Manual. Where bituminous base flashings are provided, the counter flashing shall extend down as close as practicable to the top of the cant strip.

3.7.3 Through-Wall Flashing

Through-wall flashing includes sill, lintel, and spandrel flashing. The flashing shall be laid with a layer of mortar above and below the flashing so that the total thickness of the two layers of the mortar and flashing are the same thickness as the regular mortar joints. Flashing shall not extend further into the masonry backup wall than the first mortar joint. Joints in flashing shall be lapped and sealed. Flashing shall be one piece for lintels and sills.

3.7.3.1 Lintel Flashing

Lintel flashing shall extend the full length of lintel. Flashing shall extend through the wall one masonry course above the lintels and shall be bent down over the vertical leg of the outer steel lintel angle not less than 50 mm, or shall be applied over top of masonry and precast concrete lintels. Bed joints of lintels at control joints shall be underlaid with sheet metal bond breaker.

3.7.3.2 Sill Flashing

Sill flashing shall extend the full width of the sill and not less than 100 mm beyond ends of sill except at control joint where the flashing shall be terminated at the end of the sill.

3.7.4 Valley Flashing

Valley flashing shall be installed as specified in SMACNA Architectural Manual and as indicated.

3.8 GRAVEL STOPS AND FASCIA

Gravel stops and fascia shall be fabricated and installed as indicated and in accordance with SMACNA Architectural Manual.

3.9 INSTALLATION OF LOUVERS

Louvers shall be rigidly attached to the supporting construction. The installation shall be rain-tight. Louver screen shall be installed as indicated.

3.10 REGLETS

Reglets shall be a factory fabricated product of proven design, complete with fittings and special shapes as required. Open-type reglets shall be filled with fiberboard or other suitable separator to prevent crushing of the slot during installation. Reglet plugs shall be spaced not over 300 mm on centers and reglet grooves shall be filled with sealant. Friction or slot-type reglets shall have metal flashings inserted the full depth of slot and shall be lightly punched every 300 mm to crimp the reglet and counter flashing together.

3.11 SCUPPERS

Line interior of scupper openings with sheet metal. Extend the lining through and project outside of the wall to form a drip on the bottom edge and to form a return not less than 25 mm against the face of the outside wall at the top and sides. Fold outside edges under 13 mm on all sides. Provide the perimeter of the lining approximately 13 mm less than the perimeter of the scupper. Join the sides of the lining on the roof deck side to a closure flange by a locked and soldered joint. Join the bottom edge by a locked and soldered joint to the closure flange, where required, form with a ridge to act as a gravel stop around the scupper inlet. Provide surfaces to receive the scupper lining and coat with bituminous plastic cement.

3.12 ROOF EXPANSION JOINTS

Consist of curb with wood nailing members on each side of joint, bituminous base flashing, metal counterflashing, and metal joint cover. Bituminous base flashing is specified in Roofing Section. Provide counterflashing as specified in paragraph "Counterflashing," except as follows: provide counterflashing with vertical leg of suitable depth to enable forming into a horizontal continuous cleat. Secure the inner edge to the nailing member. Make the outer edge projection not less than 25 mm for flashing on the other side of the joint. Hook the expansion joint cover over the projecting outer edges of counterflashing. Provide roof joint with a joint cover of the width indicated. Hook and lock one edge of the joint cover over the shorter projecting flange of the continuous cleat, and the other edge hooked over and loose locked with the longer projecting flange. Joints are specified in Table II.

3.13 INSTALLATION ACCESSORIES FOR SELF-ADHESIVE SHEET WATERPROOFING MEMBRANE

3.13.1 Primer

Fast-drying, solvent-based rubber material, made by manufacturer, specifically intended for use with membrane.

- a. High solids content, with low volatile organic compound emissions.
- b. Provide special primer formulation for application at temperatures below 40 degrees F.

3.13.2 Detailing Mastic

Solvent-based rubberized asphalt mastic, made by manufacturer of membrane for sealing of edges and penetrations.

3.13.3 Latex-Modified Mortar

Proprietary; premixed and bagged, or site-mixed as follows:

- a. Latex (acrylic) admixture: Proprietary non-re-emulsifiable acrylic liquid compound, specifically manufactured to improve cohesion, tensile strength, and adhesive properties of portland cement mortars and concrete.
- b. Sand: Clean, sharp masonry sand; ASTM C 144.
- c. Cement: ASTM C 150, Type I.
- d. Mix: 2-1/2 parts sand (by volume), 1 part cement, 50/50 mix of water and latex admixture to provide workability.

3.14 FIELD QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.
- b. Verification of compliance of materials before, during, and after installation.
- c. Inspection of sheet metalwork for proper size and thickness, fastening and joining, and proper installation.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer at the end of each day.

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SECTION 07840A

FIRESTOPPING

08/00

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SECTION 07840A

FIRESTOPPING
08/00

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84	(1999) Surface Burning Characteristics of Building Materials
ASTM E 814	(1997) Fire Tests of Through-Penetration Fire Stops

UNDERWRITERS LABORATORIES (UL)

UL 723	(1996; Rev thru Dec 1998) Test for Surface Burning Characteristics of Building Materials
UL 1479	(1994; Rev thru Feb 1998) Fire Tests of Through-Penetration Firestops
UL 2079	Tests for Fire Resistance of Building Joint Systems
UL Fire Resist Dir	(2001) Fire Resistance Directory (2 Vol.)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping Materials.

Detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resist Dir or other details

certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgement, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal shall indicate the firestopping material to be provided for each type of application. When more than 5 penetrations or construction joints are to receive firestopping, drawings shall indicate location and type of application.

SD-07 Certificates

Firestopping Materials.

Certificates attesting that firestopping material complies with the specified requirements. In lieu of certificates, drawings showing UL classified materials as part of a tested assembly may be provided. Drawings showing evidence of testing by an alternate nationally recognized independent laboratory may be substituted.

Installer Qualifications.

Documentation of training and experience.

Inspection.

Manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

1.3 GENERAL REQUIREMENTS

1.3.1 Through Penetrations and Joints

Firestopping shall consist of furnishing and installing tested and listed firestop systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions and floors, including through-penetrations and construction joints and gaps.

Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint. Gaps requiring firestopping include gaps between the top of the fire-rated walls and the roof or floor deck above, and building expansion joints in walls and ceilings. Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience. Provide components of fire-resistive joint systems, including forming materials, that are needed to install fill materials and to comply with specified fire-resistance

rating. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

1.4 STORAGE AND DELIVERY

Materials shall be delivered in the original unopened packages or containers showing name of the manufacturer and the brand name. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

1.5 INSTALLER QUALIFICATIONS

The Contractor shall engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer qualification on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures.

1.6 COORDINATION

The specified work shall be coordinated with other trades. Firestopping materials, at penetrations of pipes and ducts, shall be applied prior to insulating, unless insulation meets requirements specified for firestopping. Firestopping materials at building joints and construction gaps shall be applied prior to completion of enclosing walls or assemblies.

Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible.

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS

Firestopping materials shall consist of commercially manufactured, asbestos-free products complying with the following minimum requirements:

2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resist Dir or by a nationally recognized testing laboratory.

2.1.2 Toxicity

Material shall be nontoxic to humans at all stages of application.

2.1.3 Fire Resistance Rating

Firestopping will not be required to have a greater fire resistance rating than that of the assembly in which it is being placed.

2.1.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph GENERAL REQUIREMENTS, shall provide "F" fire resistance ratings in accordance with ASTM E 814 or UL 1479. Fire resistance ratings shall be as follows:

- a. Penetrations of Fire Resistance Rated Walls and Partitions: F
Rating = Rating of wall or partition being penetrated.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement shall be sound and capable of supporting device.

3.2 INSTALLATION

Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 100 mm or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Firestopping shall be installed in accordance with manufacturer's written instructions. Tested and listed firestop systems shall be provided in the following locations, except in floor slabs on grade:

- a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, and partitions.
- b. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
- c. Construction joints in floors and fire rated walls and partitions.
- d. Other locations where required to maintain fire resistance rating of the construction.

3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Thermal insulation shall be replaced with a material having equal thermal insulating and firestopping characteristics.

3.2.2 Fire Dampers

Fire dampers shall be installed and firestopped in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.3 INSPECTION

Firestopped areas shall not be covered or enclosed until inspection is complete and approved. A manufacturer's representative shall inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements.

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06/97

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SECTION 07900

JOINT SEALING

06/97

PART 1 GENERAL

Provide sealant that has been tested and found suitable for the substrates to which it will be applied. Fire rated joints should be filled as specified in Section 07840 FIRESTOPPING.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. All the latest versions of the referenced publications shall be used.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509	Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C 719	Joint Movement Capability of Sealants
ASTM C 734	Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C 834	Latex Sealants
ASTM C 920	Elastomeric Joint Sealants
ASTM C 1184	Structural Silicone-Sealants
ASTM D 1056	Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1565	Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam)
ASTM E 84	Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be

submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Identify and submit table in the format prescribed in Section 2.1, by location.

Backing.

Bond-Breaker.

Sealant.

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). A copy of the Material Safety Data Sheet shall be provided for each solvent, primer or sealant material.

SD-07 Certificates

Sealant.

Certificates of compliance stating that the materials conform to the specified requirements.

1.3 ENVIRONMENTAL REQUIREMENTS

The ambient temperature shall be within the limits of 4 to 32 degrees C, as recommended by the manufacturer, when the sealants are applied.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original unopened containers. The container label or accompanying data sheet shall include the following information as applicable: manufacturer, name of material, lot number, color, date of expiration, mixing instructions, and curing time at the standard conditions for laboratory tests. Materials shall be handled and stored to prevent inclusion of foreign materials. Materials shall be stored at temperatures as recommended by the manufacturer.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

The following is offered as guidance and is not intended to omit locations that meet standard of care.

2.1.1 Interior Sealant

ASTM C 920, Type S or M, Grade NS, Class 12.5, NT.

ASTM C 920 Mildew Resistant Silicone Sealant, Type S, Grade NS, Class 25,

NT.

ASTM C 1184 Structural Silicone, non-acid curing, Type S, Grade NS, Class 25, NT.

At painted surfaces in gypsum wallboard, use latex sealant. At all laboratory locations and exposed conditions use clear mildew resistant silicone sealant. Use structural silicone sealant as designated and as recommended by the manufacturer at glass display cases.

LOCATION

- a. Small voids between walls or partitions and adjacent lockers, casework, shelving, door frames, built-in or surface-mounted equipment and fixtures, and similar items.
- b. Perimeter of frames at doors, windows, and access panels which adjoin exposed interior concrete and masonry surfaces.
- c. Joints of interior masonry walls and partitions which adjoin columns, pilasters, concrete walls, and exterior walls unless otherwise detailed.
- d. Joints between edge members for acoustical tile and adjoining vertical surfaces.
- e. Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.
- f. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where nonplaner tile surfaces meet.
- g. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.
- h. Behind escutcheon plates at valve pipe penetrations and shower heads in showers.
- i. Use structural sealant for supporting weight of glass or thin stone.

2.1.2 Sealant

Structural silicone - non-acid curing - ASTM C 1184. ASTM C 920, Type S, Grade NS, Class 25, NT.

Neutral cure silicone sealant - ASTM C 719. ASTM C 920, Type S, Grade NS, Class 25, T.

50% - 100% movement capability to be used. Use structural silicone unless otherwise noted. Use neutral cure silicone in all flatwork.

LOCATION

- a. Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.
- b. Masonry joints where shelf angles occur.
- c. Expansion and control joints.
- d. Interior face of expansion joints in exterior concrete or masonry walls where metal expansion joint covers are not required.
- e. Voids where items pass through exterior walls.
- f. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.
- g. Metal-to-metal joints where sealant is indicated or specified.
- h. Joints between ends of gravel stops, fascias, copings, and adjacent walls.

2.1.3 Floor Joint Sealant

LOCATION

- a. Seats of metal thresholds for exterior doors.
- b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.

2.2 BACKING

Backing shall be 25 to 33 percent oversize for closed cell or open cell material, as recommended by manufacturer, unless otherwise indicated.

2.2.1 Rubber

Cellular rubber sponge backing shall be ASTM D 1056, Type 2, closed cell, Class A, round cross section.

2.2.2 PVC

Do not use open cell vinyl foam in moist areas or below grade.

Polypropylene or Polyethelene backing shall be ASTM D 1565, Grade VO 12, open-cell foam, round cross section.

2.2.3 Synthetic Rubber

Synthetic rubber backing shall be ASTM C 509, Option I, Type II preformed rods or tubes.

2.2.4 Neoprene

Neoprene backing shall be ASTM D 1056, closed cell expanded neoprene cord Type 2, Class C, Grade 2C2 or open cell neoprene sponge Type 1, Class C, Grade 1C3.

2.3 BOND-BREAKER

Bond-breaker shall be as recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

2.4 PRIMER

Primer shall be non-staining type as recommended by sealant manufacturer for the application.

2.5 CAULKING

The term "caulking" is limited herein to latex caulking which should be used only indoors and where there is little or no anticipated joint movement.

2.6 SEALANT

Use an elastomeric sealant where joints are subject to movement due to thermal expansion and dissimilar materials.

2.6.1 LATEX

Latex Sealant shall be in accordance with ASTM C 834.

2.6.2 ELASTOMERIC - STRUCTURAL SILICONE

Use structural silicone sealant for supporting weight of glass or thin stone. Elastomeric sealants shall conform to ASTM C 1184. Neutral cure silicone, that allows +/- 50% movement, ASTM C 920, Type S, Grade NS, Class 25, use NT, M, Grand A.

2.6.3 ACOUSTICAL

Rubber or polymer-based acoustical sealant shall have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84. Acoustical sealant shall have a consistency of 250 to 310 when tested in accordance with ASTM D 217, and shall remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C 734, and shall be non-staining. Use acoustical sealant at all duct penetrations, except at fire penetration conditions.

2.6.4 BUTYL

Butyl sealant shall be ASTM C 1085.

2.6.5 PREFORMED

Preformed sealant shall be polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealant capable of sealing out moisture, air and dust when installed as recommended by the manufacturer. At temperatures from minus 34 to plus 71 degrees C , the sealant shall be non-bleeding and shall have no loss of adhesion.

2.6.5.1 Tape

Tape sealant: As recommended by manufacturer.

2.6.5.2 Bead

Bead sealant: As recommended by manufacturer.

2.6.5.3 Foam Strip

Foam strip shall be polyurethane foam. Foam strip shall be capable of sealing out moisture, air, and dust when installed and compressed as recommended by the manufacturer. Service temperature shall be minus 40 to plus 135 degrees C. Untreated strips shall be furnished with adhesive to hold them in place. Adhesive shall not stain or bleed into adjacent finishes. Treated strips shall be saturated with butylene waterproofing or impregnated with asphalt.

2.7 SOLVENTS AND CLEANING AGENTS

Solvents, cleaning agents, and accessory materials shall be provided as recommended by the manufacturer.

PART 3 EXECUTION

3.1 GENERAL

Coordinate painted areas with sealants that are acceptable substrates for painting.

3.1.1 Surface Preparation

The surfaces of joints to receive sealant or caulk shall be free of all frost, condensation and moisture. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from surfaces of joints to be in contact with the sealant.

Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths. For surface types not listed below, the sealant manufacturer shall be contacted for specific recommendations.

3.1.2 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

3.1.3 Steel Surfaces

Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

3.1.4 Aluminum Surfaces

Aluminum surfaces to be in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall be as recommended by the manufacturer of the aluminum work and shall be non-staining.

3.1.5 Wood Surfaces

Wood surfaces to be in contact with sealants shall be free of splinters and sawdust or other loose particles.

3.2 APPLICATION

3.2.1 Masking Tape

Masking tape may be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

3.2.2 Backing

Backing shall be installed to provide the indicated sealant depth. The installation tool shall be shaped to avoid puncturing the backing.

3.2.3 Bond-Breaker

Bond-breaker shall be applied to fully cover the bottom of the joint

without contaminating the sides where sealant adhesion is required.

3.2.4 Primer

Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not be primed.

3.2.5 Sealant

Sealant shall be used before expiration of shelf life. Multi-component sealants shall be mixed according to manufacturer's printed instructions. Sealant in guns shall be applied with a nozzle of proper size to fit the width of joint. Joints shall be sealed as detailed in the drawings. Sealant shall be forced into joints with sufficient pressure to expel air and fill the groove solidly. Sealant shall be installed to the indicated depth without displacing the backing. Unless otherwise indicated, specified, or recommended by the manufacturer, the installed sealant shall be dry tooled to produce a uniformly smooth surface free of wrinkles and to ensure full adhesion to the sides of the joint; the use of solvents, soapy water, etc., will not be allowed. Sealants shall be installed free of air pockets, foreign embedded matter, ridges and sags. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

3.3 CLEANING

The surfaces adjoining the sealed joints shall be cleaned of smears and other soiling resulting from the sealant application as work progresses.

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DIVISION 08 - DOORS & WINDOWS

SECTION 08110

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09/99

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SECTION 08110

STEEL DOORS AND DOOR AND WINDOW FRAMES

09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A250.4 (1994) Test Procedure and Acceptance
Criteria for Physical Endurance for Steel
Doors and Hardware Reinforcings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 591/A 591M (1998) Steel Sheet, Electrolytic
Zinc-Coated, for Light Coating Mass
Applications

ASTM A 653/A 653M (1998) Steel Sheet, Zinc-Coated
(Galvanized) or Zinc-Iron Alloy-Coated
(Galvannealed) by the Hot-Dip Process

ASTM C 578 (1995) Rigid, Cellular Polystyrene Thermal
Insulation

ASTM C 591 (1994) Unfaced Preformed Rigid Cellular
Polyisocyanurate Thermal Insulation

ASTM C 665 (1998) Mineral-Fiber Blanket Thermal
Insulation for Light Frame Construction
and Manufactured Housing

ASTM D 2863 (1997) Measuring the Minimum Oxygen
Concentration to Support Candle-Like
Combustion of Plastics (Oxygen Index)

ASTM E 283 (1991) Rate of Air Leakage Through
Exterior Windows, Curtain Walls, and Doors
Under Specified Pressure Differences
Across the Specimen

DOOR AND HARDWARE INSTITUTE (DHI)

ANSI/DHI A115 (1994) Steel Door Preparation Standards
(Consisting of A115.1 through A115.6 and

A115.12 through A115.18)

HOLLOW METAL MANUFACTURER'S ASSOCIATION (HMMA)

HMMA HMM (1992) Hollow Metal Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1995) Fire Doors and Fire Windows

NFPA 252 (1995) Fire Tests of Door Assemblies

STEEL DOOR INSTITUTE (SDI)

ANSI/SDI 100 (1991) Standard Steel Doors and Frames

SDI 105 (1992) Recommended Erection Instructions
for Steel Frames

SDI 107 (1984) Hardware on Steel Doors
(Reinforcement - Application)

SDI 111B Recommended Standard Details for Dutch
Doors

SDI 111F Recommended Completed Opening Anchors for
Standard Steel Doors and Frames

SDI 113 (1979) Apparent Thermal Performance for
Steel Door and Frame Assemblies

SDI 114 (1979) Acoustical Performance for Steel
Door and Frame Assemblies

UNDERWRITERS LABORATORIES INC. (UL)

UL 10B (1997) Fire Tests of Door Assemblies

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal
Procedures."

SD-02 Shop Drawings

Doors

Frames

Accessories

Weatherstripping

Show elevations, construction details, metal gages, hardware

provisions, method of glazing, and installation details.

Schedule of doors and frames

Submit door and frame locations.

SD-03 Product Data

Doors

Frames

Accessories

Weatherstripping

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction. When "custom hollow metal doors" are provided in lieu of "standard steel doors," provide additional details and data sufficient for comparison to ANSI/SDI 100 requirements.

SD-04 Samples

Factory-applied enamel finish

Where colors are not indicated, submit manufacturer's standard colors and patterns to the Contracting Officer for selection.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 6 mm airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

ANSI/SDI 100, except as specified otherwise. Prepare doors to receive hardware specified in Section 08710, "Door Hardware." Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 44.5 mm thick, unless otherwise indicated.

2.1.1 Door Grades

2.1.1.1 Heavy Duty Doors

ANSI/SDI 100, Grade II, Model 2A, with core construction Type A for

interior doors and of size(s) and design(s) indicated.

2.1.1.2 Extra Heavy Duty Doors

ANSI/SDI 100, Grade III, Model 2A with core construction Type F for exterior doors, of size(s) and design(s) indicated. Where Type F cores are specified or scheduled, the space between the stiffeners shall be filled with mineral-fiber insulation as specified.

2.2 CUSTOM HOLLOW METAL DOORS

Provide custom hollow metal doors where nonstandard steel doors are indicated. At the Contractor's option, custom hollow metal doors may be provided in lieu of standard steel doors. Door size(s), design, materials, construction, gages, and finish shall be as specified for standard steel doors and shall comply with the requirement of HMMA HMM. Fill all spaces in doors with insulation. Close top and bottom edges with steel channels not lighter than 1.5 mm thick. Close tops of exterior doors flush with an additional channel and seal to prevent water intrusion. Prepare doors to receive hardware specified in Section 08710, "Door Hardware." Undercut doors where indicated. Doors shall be 44.5 mm thick, unless otherwise indicated.

2.3 ACCESSORIES

2.3.1 Shelves for Wicket Doors

SDI 111B. Fabricate shelves of steel not lighter than 1.5 mm thick, of the size indicated. Brackets shall be stock type fabricated of the same metal used to fabricate shelves.

2.3.2 Louvers

2.3.2.1 Interior Louvers

Louvers shall be stationary sightproof type where scheduled. Louvers for lightproof doors shall not transmit light. Weld or tenon louver blades to frame and fasten assembly to door with moldings. Detachable moldings on room or nonsecurity side of door; on security side of door, moldings to be integral part of louver. Form louvers of 0.9 mm thick steel.

2.3.2.2 Exterior Louvers

Louvers shall be inverted "V" type with minimum of 55 percent net-free opening. Weld or tenon louver blades to continuous channel frame and weld assembly to door to form watertight assembly. Form louvers of hot-dip galvanized steel of same gauge as door facings. Louvers shall have steel-framed bird screens secured to room side and readily removable. Provide aluminum wire cloth, 7 by 7 per 10 mm or 7 by 6 per 10 mm mesh, for insect screens. Net-free louver area to be before screening.

2.3.3 Astragals

For pairs of exterior steel doors which will not have aluminum astragals or

removable mullions, as specified in Section 08710, "Door Hardware," provide overlapping steel astragals with the doors. For interior pairs of fire rated doors, provide stainless steel astragals complying with NFPA 80 for fire rated assemblies.

2.3.4 Moldings

Provide moldings around glass of interior and exterior doors and louvers of interior doors. Provide nonremovable moldings on outside of exterior doors and on corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to stationary moldings, or provide snap-on moldings. Muntins shall interlock at intersections and shall be fitted and welded to stationary moldings.

2.4 INSULATION CORES

Insulated cores shall be of type specified, shall provide maximum assembly U-value of .48 in accordance with SDI 113 and shall conform to:

- a. Rigid Polyurethane Foam: ASTM C 591, Type 1 or 2, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with ASTM D 2863; or
- b. Rigid Polystyrene Foam Board: ASTM C 578, Type I or II; or
- c. Mineral Fiber: ASTM C 665, Type I.

2.5 STANDARD STEEL FRAMES

ANSI/SDI 100, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners. Provide steel frames for doors, transoms, mullions, cased openings, and interior glazed panels, unless otherwise indicated.

2.5.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

Fabricate steel frames for scheduled openings in styles and profiles as shown using concealed fasteners. Fabricate frames for interior openings over 1200 mm wide from 14-gauge cold-rolled steel sheet. Fabricate frames for exterior openings from 14-gauge thick cold-rolled galvanized steel sheet.

2.5.2 Mullions and Transom Bars

Mullions and transom bars shall be closed or tubular construction and shall member with heads and jambs butt-welded thereto or knock-down for field assembly. Bottom of door mullions shall have adjustable floor anchors and spreader connections.

2.5.3 Stops and Beads

Form stops and beads from 0.9 mm thick steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 300 to 400 mm on centers. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

2.5.4 Terminated Stops

Where indicated, terminate interior door frame stops 150 mm above floor. Do not terminate stops of frames for lightproof or soundproof doors.

2.5.5 Cased Openings

Fabricate frames for cased openings of same material, gauge, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

2.5.6 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 1.2 mm thick.

2.5.6.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 2285 mm in height, provide one additional anchor for each jamb for each additional 760 mm or fraction thereof.

- a. Masonry: Provide anchors of corrugated or perforated steel straps, or 5 mm diameter steel wire, T-shaped, with leg not less than wide by long. Anchors for fire-rated frames shall be labeled type.
- b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding;
- c. Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with SDI 111F; and

2.5.6.2 Floor Anchors

Provide two clip type floor anchors, per jamb, drilled for 10 mm anchor bolts at bottom of each jamb member. Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.

2.6 FIRE DOORS AND FRAMES

The requirements of NFPA 80 shall take precedence over details indicated or specified.

2.6.1 Labels

Fire doors and frames shall bear the label of Underwriters Laboratories, Inc. (UL), Factory Mutual Engineering Corporation (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing shall be in accordance with NFPA 252 or UL 10B. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted. All hollow metal doors in one-hour partitions shall be B-label/90-minutes

2.6.2 Astragal on Fire Doors

On pairs of labeled fire doors, conform to NFPA 80 and UL requirements.

2.7 WEATHERSTRIPPING

As specified in Section 08710, "Door Hardware."

2.7.1 Integral Gasket

Black synthetic rubber gasket with tabs for factory fitting into factory slotted frames, or extruded neoprene foam gasket made to fit into a continuous groove formed in the frame, may be provided in lieu of head and jamb seals specified in Section 08710, "Door Hardware." Insert gasket in groove after frame is finish painted. Air leakage of weatherstripped doors shall not exceed 2.19 by 10⁻⁵ cubic meters per second of air per square meter of door area when tested in accordance with ASTM E 283.

2.8 HARDWARE PREPARATION

Reinforce, drill, and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI 107 and ANSI/DHI A115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of ANSI/SDI 100, as applicable. Punch door frames, with the exception of frames that will have weatherstripping or lightproof or soundproof gasketing, to receive three silencers on strike jambs of single swing frames and two (2) silencers on heads of frames for pairs of doors, rubber or vinyl door silencers on lock side of single doors, and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

2.9 FINISHES

2.9.1 Factory-Primed Finish

Unless specified otherwise, phosphate treat and factory prime metal doors and frames as specified in ANSI/SDI 100. Where coating is removed by welding, apply touchup of factory primer.

2.9.2 Electrolytic Zinc-Coated and Factory-Primed Finish

Fabricate exterior doors and frames from electrolytic zinc-coated steel, ASTM A 591/A 591M, Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in ANSI/SDI 100. Provide for exterior doors.

2.10 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Reinforce frames wider than 1220 mm with roll formed steel channels fitted tightly into frame head. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. Frames for use in solid plaster partitions shall be welded construction. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes. On wraparound frames for masonry partitions, provide a throat opening 3 mm larger than the actual masonry thickness. Coat inside of frame profile with bituminous coating to a thickness of 1.5 mm. Install frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive calking compound. Coordinate with masonry and wallboard wall construction for anchor placement.

2.10.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Frames

Set frames in accordance with SDI 105. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Where frames require ceiling struts or overhead bracing, anchor frames to the struts or bracing. Backfill frames with mortar. When an additive is provided in the mortar, coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

3.1.2 Doors

Hang doors in accordance with clearances specified in ANSI/SDI 100. After erection and glazing, clean and adjust hardware.

3.1.3 Fire Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80. Install fire rated smoke doors and frames in accordance with NFPA 80.

3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

3.4 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements are as follows:

<u>PRODUCTS</u>	<u>INCH-POUND</u>	<u>METRIC</u>
Door thickness	1 3/4 inches	44.5 mm
Steel channels	16 gauge	1.5 mm
Steel Sheet	23 gauge	0.7 mm
	16 gauge	1.5 mm
	20 gauge	0.9 mm
	18 gauge	1.2 mm
Anchor bolts	3/8 inches	10 mm

-- End of Section --

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DIVISION 08 - DOORS & WINDOWS

SECTION 08320

BULLET RESISTANT DOORS, FRAMES, AND WINDOWS

04/02

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- 3.2 PROTECTION
- 3.3 CLEANING

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SECTION 08320

BULLET RESISTANT DOORS, FRAMES, AND WINDOWS

04/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A250.4 (1994) Test Procedure and Acceptance
Criteria for Physical Endurance for Steel
Doors and Hardware Reinforcings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 591/A 591M (1998) Steel Sheet, Electrolytic
Zinc-Coated, for Light Coating Mass
Applications

ASTM A 653/A 653M (1998) Steel Sheet, Zinc-Coated
(Galvanized) or Zinc-Iron Alloy-Coated
(Galvannealed) by the Hot-Dip Process

ASTM C 578 (1995) Rigid, Cellular Polystyrene Thermal
Insulation

ASTM C 591 (1994) Unfaced Preformed Rigid Cellular
Polyisocyanurate Thermal Insulation

ASTM C 665 (1998) Mineral-Fiber Blanket Thermal
Insulation for Light Frame Construction
and Manufactured Housing

ASTM D 2863 (1997) Measuring the Minimum Oxygen
Concentration to Support Candle-Like
Combustion of Plastics (Oxygen Index)

ASTM E 283 (1991) Rate of Air Leakage Through
Exterior Windows, Curtain Walls, and Doors
Under Specified Pressure Differences
Across the Specimen

DOOR AND HARDWARE INSTITUTE (DHI)

ANSI/DHI A115 (1994) Steel Door Preparation Standards
(Consisting of A115.1 through A115.6 and
A115.12 through A115.18)

HOLLOW METAL MANUFACTURER'S ASSOCIATION (HMMA)

HMMA HMM (1992) Hollow Metal Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1995) Fire Doors and Fire Windows
NFPA 252 (1995) Fire Tests of Door Assemblies

STEEL DOOR INSTITUTE (SDI)

ANSI/SDI 100 (1991) Standard Steel Doors and Frames
SDI 105 (1992) Recommended Erection Instructions
for Steel Frames
SDI 107 (1984) Hardware on Steel Doors
(Reinforcement - Application)
SDI 111B Recommended Standard Details for Dutch
Doors
SDI 111F Recommended Completed Opening Anchors for
Standard Steel Doors and Frames
SDI 113 (1979) Apparent Thermal Performance for
Steel Door and Frame Assemblies
SDI 114 (1979) Acoustical Performance for Steel
Door and Frame Assemblies

UNDERWRITERS LABORATORIES INC. (UL)

UL 10B (1997) Fire Tests of Door Assemblies
UL 752 Standard for Bullet Resisting Equipment

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal
Procedures."

*8

SD-02 Shop Drawings

Doors: ~~C A/E~~

Frames: ~~C A/E~~

Window Units

Show elevations, construction details, metal gages, bullet
resistant steel plate, hardware provisions, method of glazing, and
installation details.

SD-03 Product Data

Doors: ~~C A/E~~

Frames: ~~C A/E~~

Window Units

Submit manufacturer's descriptive literature for doors, frames, and window units. Include data and details on door construction, panel (internal) reinforcement, door edge construction, frame construction, and glazing to comply with ballistic safety requirements in accordance with UL 752.

SD-06 Test Reports

Test data

Manufacturer's independent test data from a recognized laboratory indicating compliance with the ballistic rating specified.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and window units undamaged and with protective wrappings or packaging. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 6 mm airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

1.4 WARRANTY

Materials and workmanship shall be warranted by the manufacturer for a period of 5 years from date of substantial completion.

PART 2 PRODUCTS

2.1 MATERIALS

1. Steel: Commercial grade, zinc coated steel to comply with ASTM A 653/A 653M.
2. Core: Core materials shall be manufacturer's proprietary bullet resistant standard tested in accordance with UL 752. Core shall provide the highest level available to protect against military assault weapons using armour piercing ballistics.
3. Glazing: Security glazing shall be factory installed. The attack resistance of the glass shall conform to that of the door and frame unit.

2.2 DOORS

Doors shall be manufactured according to proprietary tests in conformance with UL 752. Provide ballistic protection on both faces of the door. Prepare doors to receive hardware specified in Section 08710, "Door Hardware." Undercut where indicated. Doors shall be 44.5 mm thick, unless otherwise indicated.

Doors shall be swing flush type. Longitudinal edges shall be butt seamed. Top and bottom of doors shall be provided with inverted, recessed channels spot welded to door faces.

2.3 FRAMES

Frames shall be manufactured according to proprietary tests in conformance

with UL 752. Form frames to sizes and shapes indicated, with welded corners. Grind welds to a smooth uniform finish. Securely attach floor anchors to the inside of each jamb. Weld in two temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.3.1 Window Units

Window units shall be manufactured according to proprietary tests in conformance with UL 752. Window units shall be factory glazed. Form stops and beads from 4.75 mm thick flat steel, accurately fitted, and butted at corners. Secure beads to frames with oval-head, countersunk tamperproof self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 300 to 400 mm on centers.

2.3.2 Anchors

Provide anchors to secure the window unit to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 1.2 mm thick.

2.3.2.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 2285 mm in height, provide one additional anchor for each jamb for each additional 760 mm or fraction thereof.

- a. Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with SDI 111F and UL 752 requirements.

2.4 HARDWARE PREPARATION

Reinforce, drill, and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI 107 and ANSI/DHI A115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of ANSI/SDI 100, as applicable. Punch door frames to receive three silencers on strike jambs of single swing frames. Set lock strikes out to provide clearance for silencers.

2.5 FINISHES

2.5.1 Factory-Primed Finish

Unless specified otherwise, phosphate treat and factory prime metal doors, frames, and window units as specified in ANSI/SDI 100. Where coating is removed by welding, apply touchup of factory primer.

2.6 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Reinforce frames wider than 1220 mm with roll formed steel channels fitted tightly into frame head. Corner joints shall be well formed and in true alignment. Conceal fastenings where

practicable. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes. Coat inside of frame profile with bituminous coating to a thickness of 1.5 mm.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Frames

Set frames in accordance with SDI 105. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Backfill frames with grout.

3.1.2 Doors

Hang doors in accordance with clearances specified in ANSI/SDI 100. After erection and glazing, clean and adjust hardware.

3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

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SECTION 08330

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-- End of Section Table of Contents --

SECTION 08330

OVERHEAD ROLLING DOORS AND GRILLES

06/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 653/A 653M	(1999a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip process
ASTM A 167-94	(1994) Standard Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip
ASTM E 84	(1999) Surface Burning Characteristics of Building Materials
ASTM E 330	(1997e1) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)

ASHRAE HDBK-IP	(1997) Handbook, Fundamentals I-P Edition
ASHRAE HDBK-SI	(1997) Handbook, Fundamentals SI Edition

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(1993) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC
NEMA ICS 6	(1993) Industrial Control and Systems Enclosures
NEMA MG 1	(1998) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code
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NFPA 80

(1999) Fire Doors and Fire Windows

1.2 DESCRIPTION

Overhead rolling doors and security grilles shall be spring counterbalanced, rolling type, with interlocking slats or curtain, complete with guides, fastenings, hood, brackets, and operating mechanisms, and shall be designed for use on openings as indicated. Fire doors shall bear the Underwriters Laboratories, Warnock Hersey, Factory Mutual or other nationally recognized testing laboratory label for the rating listed on the door schedule. Each door shall be provided with a permanent label showing the manufacturer's name and address and the model/serial number of the door. Doors in excess of the labeled size shall be deemed oversize and shall be provided with a listing agency oversize label, or a listing agency oversize certificate, or a certificate signed by an official of the manufacturing company certifying that the door and operator have been designed to meet the specified requirements.

1.2.1 Wind Load Requirements

Doors and components shall be designed to withstand the minimum design wind load as defined in the structural drawings and specifications. Doors shall be constructed to sustain a superimposed load, both inward and outward, equal to 1-1/2 times the minimum design wind load. Calculations shall be provided that prove the door design meets the design windload requirements. As an alternative, test data showing compliance with design windload requirements for the specific door design tested in accordance with the uniform static air pressure difference test procedures of ASTM E 330 shall be provided. Recovery shall be at least 3/4 of the maximum deflection within 24 hours after the test load is removed. Sound engineering principles may be used to interpolate or extrapolate test results to door sizes not specifically tested

1.2.2 Operational Cycle Life

All portions of the door, security grille, and operating mechanism that are subject to movement, wear, or stress fatigue shall be designed to operate through a minimum number of 10 cycles per hour. One complete cycle of door operation is defined as when the door is in the closed position, moves to the full open position, and returns to the closed position.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-02 Shop Drawings

Overhead Rolling Doors Unit:~~G-A/E~~
Security Grille:~~G-A/E~~

Drawings showing the location of each door and security grille including schedules. Drawings shall include elevations of each door type and grille, details and method of anchorage, details of construction, location and installation of hardware, shape and

thickness of materials, details of joints and connections, and details of guides, power operators, controls, and other fittings.

SD-03 Product Data

Overhead Rolling Doors Unit;~~C-A/E~~
Security Grille;~~C-A/E~~

Manufacturer's catalog data, test data, and summary of forces and loads on the walls/jambs.

Manufacturer's preprinted installation instructions.

SD-06 Test Reports

Tests

Written record of fire door drop test.

SD-04 Samples

Overhead Rolling Door Unit;~~C-A/E~~

Manufacturer's standard color samples of factory applied finishes.

SD-07 Certificates

Fire Doors

Oversize labels or certificates stating that the overhead rolling doors conform to requirements of this section. Certificates for oversize fire doors stating that the doors and hardware are manufactured in compliance with the requirements for doors of this type and class and have been tested and meet the requirements for the class indicated. Certificate is not required when fire door has a listing agency label or oversize label on the door bottom bar.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manual;~~C-A/E~~

Six copies of the system operation manual and system maintenance and repair manual for each type of door, security grille, and control system.

1.4 DELIVERY AND STORAGE

Doors and security grilles shall be delivered to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Store in a dry location that is adequately ventilated and free from dirt and dust, water, and other contaminants, and in a manner that permits easy access for inspection and handling.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided.

1.6 OPERATION AND MAINTENANCE MANUALS

Operating instructions outlining the step-by-step procedures required for motorized door and grille operation shall be provided. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, troubleshooting guides, and simplified diagrams for the equipment as installed shall be provided. A complete list of parts and supplies, source of supply, and a list of the high mortality maintenance parts shall be provided.

PART 2 PRODUCTS

2.1 OVERHEAD ROLLING DOORS AND SECURITY GRILLES

Doors shall be surface-mounted type with guides at jambs set back a sufficient distance to clear the opening. Exterior doors shall be mounted as indicated. Exterior doors need to meet or exceed the requirements of the envelope design loads (wind load pressure) as defined under structural sections. Doors shall meet the criteria specified in ASTM A 167-94 and ASTM A 653/A 653M.

2.1.1 Curtains

The curtains shall roll up on a barrel supported at the head of opening on brackets, and shall be balanced by helical torsion springs. Steel or stainless steel, as noted, slats for doors less than 4.6 m wide shall be minimum bare metal thickness of 0.71 mm.. Steel slats for doors from 4.6 to 6.4 m wide shall be minimum bare metal thickness of 0.87 mm.. Slat for fire doors over 3.6 m wide and under 6 m wide shall be not less than 0.87 mm steel. Slat for fire doors 6 m wide or wider shall be not less than 1.1 mm steel.

2.1.1.1 Overhead Rolling Fire Doors

- A. Provide doors with Underwriters Laboratories, Inc. (UL) for the fire rating classification 45 minute.
- B. Fire doors are indicated on the drawings. All doors in a rated partition shall be designated as fire doors. Fire doors shall be complete with hardware, accessories, and automatic closing device. An automatic closing device shall operate upon the fusing of a 74 degree C replaceable fusible link and activation of the building's fire alarm system.
- C. Door #903 shall be stainless steel, No. 4 finish. The bottom bar shall be steel with a phosphate treatment followed by a light gray baked-on polyester powder coat; minimum .065 mm (2.5 mil) cured film thickness.
- D. Door #903 is electric operated and shall match door #903B in appearance.

2.1.1.2 Non-Rated Insulated Overhead Doors

- A. Doors shall be powdercoat gray finish. The bottom bar shall be steel with phosphate treatment followed by a light gray baked-on

polyester powder coat; minimum .065 mm cured film thickness.

2.1.1.3 Insulated Rolling Service Doors

The slat system shall supply a minimum R-value of 4 when calculated in accordance with ASHRAE HDBK-IP ASHRAE HDBK-SI. Slat shall be of the flat type as standard with the manufacturer. Slat shall consist of manufacturer's standard foam insulation or polystyrene core not less than 17 mm thick, completely enclosed within metal facings. Exterior face of slats shall be gauge as specified for curtains. Interior face shall be not lighter than 0.56 mm. The insulated slat assembly shall have a flame spread rating of not more than 25 and a smoke development factor of not more than 50 when tested in accordance with ASTM E 84.

2.1.2 Security Grille Curtains

Curtain to be fabricated from type 66 high strength nylon panels arranged in a brick style pattern. Assembled panels to have a clear aperture of 175 x 38 mm. Panels to be interconnected using continuous horizontal aluminum rods, 8 mm in diameter, 5056 H32 aluminum alloy, spaced 50 mm on center, and locked in guides with steel retention rings. Curtain assembly shall be completely de-burred and void of sharp edges. Curtain to be attached to shaft using minimum 22 gauge steel fastening sections, 100 mm in length.

2.1.2.1 Finish

Clear anodized aluminum.

2.1.3 Endlocks and Windlocks

The ends of each alternate slat for interior doors shall have steel or galvanized iron castings, in accordance with manufacturer's instructions, to resist lateral force. Endlocks shall be provided in accordance with manufacturer's listing on fire doors when required by test results performed by the code listing agency. In addition to endlocks, non-rated exterior doors shall have the manufacturer's standard windlocks as required to withstand the wind load. Windlocks shall prevent the curtain from leaving guides because of deflection from specified wind pressure.

2.1.4 Bottom Bar

The curtain shall have a standard bottom bar consisting of two hot-dip galvanized steel angles for steel doors, and heavy duty extruded aluminum, 88 mm high by 1.6 mm thick. A sensing edge shall be attached to the bottom bar of doors that are electric-power operated.

2.1.5 Door Guides

- A. Fabricate guides with a minimum of 5 mm structural steel angles. Provide windlock bars of same material as they are required to meet the design load.
- B. Guides shall be steel structural shapes or formed steel shapes, of a size and depth to provide proper clearance for operation and resistance under the design windload. Guides shall be attached to adjoining construction with fasteners recommended by the manufacturer. Spacing of fasteners shall be as required to meet the minimum design windload. Doors and guides in hazardous areas shall have static grounding.

2.1.6 Security Grille Guides

Heavy duty extruded aluminum sections designed to conceal wall attachment fasteners. Incorporate retaining strip to prevent curtain from being pulled from guides.

2.1.7 Barrel

The barrel shall be steel pipe or commercial welded steel tubing of proper diameter for the size of curtain. Deflection shall not exceed 2.5 mm per meter of span. Ends of the barrel shall be closed with metal plugs, machined to fit the pipe. Aluminum plugs are acceptable on non-fire door barrels.

2.1.8 Springs

Coordinate with manufacturer's literature to determine the amount of sideroom required for spring tension adjustment.

Oil tempered helical steel counter-balance torsion springs shall be installed within the barrel and shall be capable of producing sufficient torque to assure easy operation of the curtain. Access shall be provided for spring tension adjustment from outside of the bracket without removing the hood.

2.1.9 Brackets

Brackets shall be of a minimum of 5 mm steel plates to close the ends of the permanently lubricated ball or roller bearings at rotating support points to counter balance shaft assembly and form closures to include provision for mounting surfaces for the hood.

2.1.10 Hoods

Hoods shall be steel for exterior doors and security grilles, and stainless steel to match interior doors, with minimum bare metal thickness of 0.56 mm formed to fit contour of the end brackets, and shall be reinforced with steel rods, rolled beads, or flanges at top and bottom edges. Multiple segment and single piece hoods shall be provided with support brackets of the manufacturer's standard design as required for adequate support.

2.1.11 Weatherstripping

Exterior doors shall be fully weatherstripped/soundproofed. A compressible and replaceable weather seal shall be attached full width of the bottom bar. Weather seal at door guides shall be continuous vinyl or neoprene, bulb or leaf type, or shall be nylon-brush type. A weather baffle shall be provided to impede the air flow above the hood. Weatherstripping shall be easily replaced without special tools.

2.1.12 Operation (Provide as indicated on the drawings or in the door schedule)

2.1.12.1 Manual Crank Operation

Operation shall be by means of a vertical shaft, gear box, and reduction gearing and awning type handle. Gears shall be of high grade gray cast-iron. Gear reduction shall be provided to reduce pressure exerted on

the crank to not over 156 N.

2.1.12.2 Electric Power Operator With Auxiliary Chain Hoist Operation

Electric power operators shall be heavy-duty industrial type. The unit shall operate the door through the operational cycle life specified. The electric power operator shall be complete with electric motor, auxiliary operation, self-locking worm gear in oil bath for heavy-duty doors, brake, mounting brackets, push button controls, limit switches, magnetic reversing starter, and all other accessories necessary to operate components specified in other paragraphs of this section. The operator shall be so designed that the motor may be removed without disturbing the limit-switches settings and without affecting the emergency chain operator.

Doors shall be provided with an auxiliary operator for immediate emergency manual operation of the door in case of electrical failure. Auxiliary operation shall be by means of galvanized endless chain extending to within 915 mm of the floor. The emergency manual operating mechanism shall be so arranged that it may be operated from the floor without affecting the settings of the limit switches. A mechanical device shall be included that will disconnect the motor from the drive operating mechanism when the auxiliary operator is used. Where control voltages differ from motor voltage, a control voltage transformer shall be provided in and as part of the electric power operator system. Control voltage shall not exceed 120 volts.

a. Provide motor operated, UL listed, belt drive operator, horsepower as recommended by manufacturer (208/230V THREE PHASE SERVICE). Provide open drip proof motor, removable without affecting auxiliary hand chain or setting limit switches; auxiliary hand chain operator miterlock; UL listed thermal overload protector; electric brake and rotary unit switches; transformer with 24V control secondary; and all integral electrical components prewired to terminal blocks. Include removable electric control panel.

b. Motors: Drive motors shall conform to NEMA MG 1, shall be high-starting torque, reversible type, and shall be of sufficient wattage and torque output to move the door in either direction from any position at a speed range of 0.18 m per second (6 to 8 inches per second) without exceeding the rated capacity. Motors shall be suitable for operation on 3-phase current and shall be suitable for across-the-line starting. Motors shall be designed to operate at full capacity over a supply voltage variation of plus or minus 10 percent of the motor voltage rating. Motors shall be provided with overload protection.

c. Controls: Control equipment shall conform to NEMA ICS 2. Enclosures shall conform to NEMA ICS 6, Type 12 (industrial use), in accordance with NFPA 70. Exterior control stations shall be weatherproof key-operated type with corrosion-resistant cast-metal cover. Each control station shall be of the three position switch type, marked "OPEN," "CLOSE," and "STOP." The "OPEN" and "STOP" controls shall be of the momentary contact type with seal-in contact. The "CLOSE" control shall be of the momentary contact type. When the door is in motion and the "STOP" control is pressed, the door shall stop instantly and remain in the stop position; from the stop position, the door shall be operable in either direction by the "OPEN" or "CLOSE" controls. Controls shall be of the full-guarded type to prevent accidental operation. Readily adjustable limit switches shall be provided to automatically stop the doors at their fully open and closed positions.

d. Sensing Edge Device: The bottom edge of electric power operated doors and security grilles shall have an electric sensing edge for non-hazardous areas that will reverse the door or grille movement upon contact with an obstruction and cause the door or grille to return to its full open position. The sensing edge shall not substitute for a limit switch. Exterior doors shall be provided with a combination compressible weather seal and sensing edge.

e. Electrical Work: Conduit and wiring necessary for proper operation shall be provided under Section 16415 ELECTRICAL WORK, INTERIOR. Flexible connections between doors and fixed supports shall be made with flexible type SJO cable, except in hazardous locations where wiring shall conform to NFPA 70, as appropriate. The cable shall have a spring-loaded automatic take up reel or a coil cord equivalent device.

2.1.12.3 Insulated Overhead Rolling Door

- A. Doors, MECHANICAL ROOMS OVERHEAD DOORS #923A, #923B, #923C, and #923D.
- B. Overhead doors shall be G60 coated with primer coat, galvanized steel finished with a phosphate treatment followed by baked-on polyester powder coat, color to be selected by Architect, from standard range not less than 30 colors, minimum of .065 mm cured film thickness, ASTM D-3363 pencil hardness: H or better.
- C. Insulated overhead rolling doors shall be manually operated.
- D. The bottom bar will be of same materials with finish to match doors.
- E. Doors and grilles shall be electrically operated as scheduled, or where power is provided.

Manually opened doors shall be operated by means of manual crank. Provide manual crank hoist operator, including crank gearbox, steel crank drive shaft and geared reduction unit. Fabricate gear box to completely enclose operating mechanism and be oil-tight.

2.1.13 Inertia Brake

Interior overhead rolling door and door #903B shall have a mechanical inertia brake device which will stop the door from free fall in any position, should there be a failure in the motor operator brake or roller chain drive. The unit shall be capable of being reset with a back drive action.

2.1.14 Locking

Locking shall consist of locking disc or slide bolt, suitable for padlock by others, for crank operated doors. Locking for motor operated doors shall consist of self-locking gearing with chain lock for emergency hand chain.

PART 3 EXECUTION

3.1 INSTALLATION

Doors and grilles shall be installed in accordance with approved detail drawings and manufacturer's instructions. Anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories shall be accurately located. Upon completion, doors shall be free from warp, twist, or distortion. Doors shall be lubricated, properly adjusted, and demonstrated to operate freely. Fire doors shall be installed in conformance with the requirements of NFPA 80 and the manufacturer's instructions.

3.2 TESTS

The fire doors shall be drop tested in accordance with NFPA 80 to show proper operation and full automatic closure and shall be reset in accordance with the manufacturer's instructions. A written record of initial test shall be provided to the Contracting Officer.

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SECTION 08460

AUTOMATIC SLIDING DOORS

08/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA 45 (1980) Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101 (1997) Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors

AAMA 800 (1992; Addenda 1994) Sealants

AAMA 1503 (1998) Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1048 (1997; Rev. B) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass

ASTM D 3656 (1997) Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

ASTM E 437 (1992) Industrial Wire Cloth and Screens (Square Opening Series)

ASTM F 842 (1997) Measuring the Forced Entry Resistance of Sliding Door Assemblies, Excluding Glazing Impact

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201 Architectural Glazing Materials

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

*8

SD-02 Shop Drawings

Automatic sliding doors; ~~C-A/E~~

Submit drawings for automatic sliding doors, operators, and

accessories that indicate elevations of each door type, full size sections, thickness, nominal gages of metal, fastenings, proposed method of installation and anchoring, the size and spacing and method of glazing, details of operating hardware, method and material for weatherstripping, and type of finish.

SD-03 Product Data

Automatic sliding doors:~~C A/E~~

Door Operators:~~C A/E~~

Hardware:~~C A/E~~

Weatherstripping:~~C A/E~~

Finish:~~C A/E~~

Describe each type of automatic sliding door, hardware, fastener, accessory, and finish. Include descriptive literature, detailed specifications, and performance test data.

SD-04 Samples

Finish

Submit color chart of factory color coatings when factory-finished color coating is to be provided.

SD-10 Operation and Maintenance Data

Automatic sliding doors:~~C A/E~~

Submit Data Package 1 in accordance with Section 01700, "Operation and Maintenance Data."

1.3 DELIVERY AND STORAGE

Inspect automatic sliding doors, hardware and accessories, for damage and unload and store doors upright on platforms in accessible spaces with a minimum of handling. The storage spaces shall be dry, adequately ventilated, free from heavy dust and not subject to combustion products, sources of water or other conditions that could damage the door. Storage spaces shall have easy access for inspection and handling of doors.

1.4 WARRANTY

Warranty Period: Three years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 AUTOMATIC SLIDING DOORS

Provide manufacturer's standard automatic entrance door system, complete with doors, sidelite and transom framing, operators, controls, activation devices, safety devices, and accessories as indicated. Comply with the following:

2.1.1 Configuration

Telescoping sliding doors with emergency breakaway capability.

2.1.2 Activation Devices

Activate doors by wall push-plate switch.

2.1.3 Doors

Provide manufacturer's standard 44.5 mm thick glazed doors with minimum 3.2 mm thick, extruded tubular stile and rail members. Fabricate corners with mechanically fastened reinforcing brackets or by welding. Incorporate concealed tie-rods that span full length of top and bottom rails.

2.1.4 Framing

Fabricate from extruded aluminum or formed-aluminum sheet or plate.

2.1.5 Header

Fabricated from minimum 3.2 mm thick, extruded aluminum or formed-aluminum sheet or plate. Conceal operator and roller track in header, providing access by means of hinged or removable access panel to permit service and adjustment. Secure panel to prevent unauthorized access. Fabricate header to match depth of framing and to extend full width of door opening.

2.1.6 Carrier Assembly and Overhead Roller Track

Manufacturer's standard carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.

2.1.7 Sills

Manufacturer's standard sill members and bottom guide system, with stainless-steel ball-bearing-center roller wheels, and threshold.

2.1.8 Hardware

Refer to Division 8 Section "Door Hardware" for requirements for hardware items other than those indicated to be provided by automatic entrance door manufacturer.

2.1.8.1 Emergency Breakaway Hardware

Provide release hardware that allows panel to swing out in the direction of egress to a full 90 degrees from any position in the sliding mode. Maximum force to open panel shall be 222 N according to ANSI/BHMA A156.10. Interrupt operation of breakaway panel operator while in the breakaway mode.

2.1.9 Automatic Locking

Provide an electrically controlled device to automatically lock door in the closed position after each cycle. Include exit device indicated to permit door activation from inside for emergency egress.

2.1.10 Glazing

Glazing shall be as indicated on the drawings and as specified in Section 08810 Glass and Glazing.

2.1.11 Weatherstripping

Provide four sides of each sliding panel and interlocking stiles and jambs with weatherstripping. Weatherstripping shall conform to AAMA 101 and shall provide maximum protection against the elements and be designed for ease of replacement.

2.1.12 Finish

Finish and color to match curtain wall system specified in Section 08900.

2.2 DOOR OPERATORS

Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Comply with the following:

1. Type: Power operated, complying with ANSI/BHMA A156.10.
2. Connections: Provide connections for power and control wiring.
3. Microprocessor Control: System that automatically defines and sets opening and closing parameters.
4. On/Off Feature: Provide on/off/hold-open switch to control electric power to operator.

2.2.1 Electromechanical Operators

Self-contained overhead units, with power opening and closing mechanism and with checking in both opening and closing cycles. Provide safety-release clutch for obstructed closing. Provide for manual sliding when power is off. Provide operator action as indicated.

2.3 ACTIVATION AND SAFETY DEVICES

Manufacturer's standard semiflush, wall-mounted, door control switch; consisting of round or square, flat stainless steel push plate; and controlling actuator mounted in recessed junction box on each face of door.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Doors, Frames, and Accessories

Install doors, frames, framing members, hardware, and accessories in accordance with approved shop drawings and the requirements specified herein. Set frames securely anchored in place to straight, plumb, square, level condition without distortion and in alignment. Install door panels to retain proper weathering contact with frames. Calk metal-to-metal joints between frame members and remove excess material. Sealing around perimeter of door frame and wall openings to provide weathertight installation shall be accomplished in accordance with AAMA 800 and manufacturer's recommendations. Finished work shall be rigid, neat in appearance, and free from defects. Upon completion, adjust sliding doors

to operate properly. Thoroughly clean aluminum frames and glass in accordance with manufacturer's recommendation. Doors damaged prior to completion and acceptance shall be restored to original manufactured condition or replaced with new doors as directed.

3.1.2 Protection of Aluminum from Dissimilar Materials

3.1.2.1 Aluminum to Dissimilar Metals

Prevent aluminum surfaces from contacting dissimilar metals other than stainless steel, zinc, or white bronze by one or a combination of the following:

- a. Paint dissimilar metal with one coat of heavy-bodied bituminous paint.
- b. Apply calking between aluminum and dissimilar metal.
- c. Paint dissimilar metal with primer, followed by one coat of aluminum paint or other suitable lead-free coating.
- d. Use nonabsorptive tape or gasket in permanently dry locations.

3.1.2.2 Drainage from Dissimilar Metals

Paint dissimilar metals located in areas where their drainage washes over aluminum to prevent the staining of aluminum.

3.1.2.3 Aluminum to Masonry and Concrete

Prevent aluminum surfaces from coming into contact with mortar, concrete, or other masonry materials by applying one coat of heavy-bodied bituminous paint to the aluminum surfaces.

3.1.2.4 Aluminum to Wood

Prevent aluminum surfaces from coming into contact with wood, treated wood, or similarly absorptive materials by one or a combination of the following methods:

- a. Paint aluminum surfaces with two coats of aluminum paint or one coat of heavy-bodied bituminous paint.
- b. Paint the wood, treated wood, or other absorptive surfaces with two coats of aluminum paint and seal contiguous joints with calking compound.

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SECTION 08710

DOOR HARDWARE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283 (1991) Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM F 883 (1990) Padlocks

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION, INC. (BHMA)

ANSI/BHMA A156.1 (1997) Butts and Hinges (BHMA 101)

ANSI/BHMA A156.3 (1994) Exit Devices (BHMA 701)

ANSI/BHMA A156.4 (1992) Door Controls - Closers (BHMA 301)

ANSI/BHMA A156.5 (1992) Auxiliary Locks & Associated Products (BHMA 501)

ANSI/BHMA A156.6 (1994) Architectural Door Trim (BHMA 1001)

ANSI/BHMA A156.7 (1988) Template Hinge Dimensions

ANSI/BHMA A156.8 (1994) Door Controls - Overhead Holders (BHMA 311)

ANSI/BHMA A156.13 (1994) Mortise Locks & Latches (BHMA 621)

ANSI/BHMA A156.16 (1997) Auxiliary Hardware

ANSI/BHMA A156.18 (1993) Materials and Finishes (BHMA 1301)

ANSI/BHMA A156.21 (1996) Thresholds

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1999) Fire Doors and Fire Windows

NFPA 101 (1997) Life Safety Code
STEEL DOOR INSTITUTE (SDI)
ANSI/SDI 100 (1991) Standard Steel Doors and Frames
UNDERWRITERS LABORATORIES INC. (UL)
UL BMD (1999) Building Materials Directory
UL 14C (1999) Swinging Hardware for Standard
Tin-Clad Fire Doors Mounted Singly and in
Pairs

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

Hardware schedule

Keying system; G RE

Wiring Diagrams for Control Systems

SD-03 Product Data

Hardware items

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Hardware Schedule

SD-11 Closeout Submittals

Key bitting

1.3 HARDWARE SCHEDULE

Construct doors and frames with requirements specified elsewhere in Division 8.

- a. The door hardware and frame schedule as submitted by the hardware consultant shall include information relating to:
 1. The location (by room), type, size, fire rating, material and finish of doors.
 2. The choice of hardware set for each door.

3. The type and finish for each door frame.
4. The reference detail for each threshold configuration for each door.
5. Detail for head and jamb details for door frames.

Prepare and submit hardware schedule in the following form:

Hard- ware Item	Quan- tity	Size	Reference		Mfr. Name and Catalog No.	Key Con- trol Symbols	UL Mark	
			Publi- cation Type No.	Finish			(If fire rated and listed)	ANSI/BHMA Finish Designa- tion
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1.4 KEY BITTING CHART REQUIREMENTS

Submit key bitting charts to the Contracting Officer prior to completion of the work. Include:

- a. Complete listing of all keys (AA1, AA2, etc.).
- b. Complete listing of all key cuts (AA1-123456, AA2-123458).
- c. Tabulation showing which key fits which door.
- d. Copy of floor plan showing doors and door numbers.
- e. Listing of 20 percent more key cuts than are presently required in each master system.

1.5 QUALITY ASSURANCE

1.5.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, and closers of one lock, hinge, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

- A. The manufacturer shall be a company specializing in manufacturing the products specified in this section with a minimum of five years documented experience.
- B. The Hardware Supplier and Installer shall be approved by the manufacturer. It shall be a company with a minimum of 5 years experience.
- C. Hardware Supplier shall employ an Architectural Hardware Consultant to assist in the work in this section.
- D. Regulatory Requirements must conform to applicable codes for requirements applicable to fire doors and frames.
- E. Products requiring electrical connection shall be listed and classified by Underwriters Laboratories, Inc., testing firm

acceptable to the authority having jurisdiction as suitable for the purpose specified indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown in hardware schedule. Deliver permanent keys and removable cores to the Contracting Officer, either directly or by certified mail. Deliver construction master keys with the locks.

PART 2 PRODUCTS

2.1 TEMPLATE HARDWARE

Hardware to be applied to metal or to prefinished doors shall be made to template. Promptly furnish template information or templates to door and frame manufacturers. Template hinges shall conform to ANSI/BHMA A156.7. Coordinate hardware items to prevent interference with other hardware.

2.2 HARDWARE FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of NFPA 80 for fire doors and NFPA 101 for exit doors, as well as to other requirements specified, even if such hardware is not specifically mentioned under paragraph entitled "Hardware Schedule." Such hardware shall bear the label of Underwriters Laboratories, Inc., and be listed in UL BMD or labeled and listed by another testing laboratory acceptable to the Contracting Officer.

2.3 HARDWARE ITEMS

Hinges, locks, latches, exit devices, bolts, and closers shall be clearly and permanently marked with the manufacturer's name or trademark where it will be visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover.

2.3.1 Hinges

Hinges shall meet the standards specified in ANSI/BHMA A 156.1.

Performance Requirements

- A. Screws: Provide Phillips flat-head screws complying with the following requirements:
 - (1) For metal doors and frames, install machine screws into drilled and tapped holes.
 - (2) Finish screw heads to match surface of hinges.
- B. Hinge pins: Except as otherwise indicated, provide hinge pins as follows:

- (1) Out-Swing Exterior Doors: Non-removable pins.
- (2) Out-Swing Corridor Doors with Locks: Non-removable pins.
- (3) Interior Doors: Non-rising pins.
- (4) Tips: Flat button and matching plug. Finished to match leafs.
- C. Size: Size hinges in accordance with specified manufacturer's published recommendations.
- D. Quantity: Furnish one pair of hinges for all doors up to 1500mm. Furnish one additional hinge for each 750mm or fraction thereof (Type (L) Door - provide 6 per jamb min.).

Hinge Sizes Chart

<u>Thickness of Doors</u> in Millimeters	<u>Width of Doors</u> in Millimeters	<u>Height of Hinge</u> (Length of Joint) in Millimeters
44 (typ)	Over 915 to 1220	127 Heavy Weight
44	Over 1220	152 Heavy Weight
51, 57, and 64	To 1065	127 Heavy Weight
51, 57, and 64 (Type L)	Over 1065	152 Heavy Weight

2.3.1.1 Continuous Hinges

Performance requirements: full mortise, templated, anodized aluminum.

2.3.2 Locks and Latches

2.3.2.1 Mortise Locks and Latches

Meet the requirements defined in the ANSI/BHMA 156.13, "Mortise Locks and Latches (BHMA 611)."

Performance Requirements

- A. Locksets and latchsets to be UL Listed heavy-duty mortise type 70mm backset.
- B. Latch bolts to be 20mm throw stainless steel anti-friction.
- C. Provide appropriate strikes, with lip to center dimensions required with wrought strike boxes.
- D. Finish to be BHMA 630-SS. Knobs and Roses of mortise locks shall have screwless shanks and no exposed screws.

ANSI/BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. Provide mortise locks with escutcheons not less than 178 by 57 mm with a

bushing at least 6 mm long. Cut escutcheons to suit cylinders and provide trim items with straight, beveled, or smoothly rounded sides, corners, and edges. Provide solid cast levers with ends that return to the door.

2.3.3 Exit Devices

Performance Requirements

- A. Exit devices shall be "UL" listed for life safety. All exit devices for fire-rated openings shall have "UL" labels for "Fire Exit Hardware."
- B. All exit devices shall be made of stainless steel, material plated to the standard architectural finishes to match the balance of the door hardware. Painted or anodized aluminum finishes are not accepted. Touch pad shall be stainless steel.
- C. Provide appropriate strikes, with lip to center dimensions required with wrought strike boxes.
- D. All exit devices shall be from one manufacturer.

All series exit devices shall incorporate a fluid damper, which decelerates the touchpad on its return stroke and eliminates noise associated with exit device operation. All exit devices shall be non-handed. Touch pad shall extend a minimum of 1/2 of the door width and shall be a minimum of 56mm in height. Reset lever to its operating position by a simple uplift motion. All latchbolts to be the dead locking type. Latchbolts shall have a self-lubricating coating to reduce wear. Plated or plastic coated latchbolts are not acceptable.

ANSI/BHMA A156.3, Grade 1. Provide adjustable strikes for rim type and vertical rod devices. Provide open back strikes for pairs of doors with mortise and vertical rod devices. Touch bars shall be provided in lieu of conventional crossbars and arms. Provide escutcheons, not less than 178 by 57 mm.

2.3.4 Cylinders and Cores

Required Manufacturer: Best Locking Systems

Performance Requirements

- A. Use the Grand master lock to meet the requirement of the Owner's existing system.
- B. Equip locks with cylinders for interchangeable-core pin tumbler inserts. Furnish only temporary inserts for the construction period, and remove these when directed.
- C. Furnish final cores and keys for installation by Owner.
- D. Metals: Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.

E. Comply with Owner's instructions for master keying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks.

(1) Permanently inscribe each key with number of lock that identifies cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE."

F. Key material: Provide keys of nickel silver only.

G. Key quantity: Furnish 3 change keys for each lock, 6 master keys for each master system, and 5 grandmaster keys for each grandmaster system.

(1) Furnish one extra blank for each lock.

(2) Deliver keys to the contracting officer.

Provide cylinders for new locks, including locks provided under other sections of this specification. Cylinders shall be fully compatible with products of the Best Lock Corporation and shall have interchangeable cores which are removable by a special control key. The cores shall have seven pin tumblers and shall be factory set using the A4 system and F keyway. Submit a core code sheet with the cores. The cores shall be master keyed in one system for this project. Provide construction interchangeable cores.

2.3.5 Keying System

Provide a grand master keying system. Provide construction interchangeable cores. Provide key cabinet as specified.

2.3.6 Lock Trim

Cast construction and commercial plain design.

2.3.6.1 Lever Handles

Provide lever handles in lieu of knobs in all locations. Lever handles for exit devices shall meet the test requirements of ANSI/BHMA A156.13 for mortise locks. Lever handle locks shall have a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when a force in excess of that specified in ANSI/BHMA A156.13 is applied to the lever handle. Lever handles shall return to within 13 mm of the door face.

2.3.6.2 Texture

Provide knurled or abrasive coated knobs or lever handles for doors which are accessible to blind persons and which lead to mechanical and utility areas.

2.3.7 Keys

Furnish one file key, one duplicate key, and one working key for each key change and for each master and grand master keying system. Furnish one additional working key for each lock of each keyed-alike group. Furnish two grand master keys, ten construction master keys, one control key for removable cores. Furnish a quantity of key blanks equal to 20 percent of the total number of file keys. Stamp each key with appropriate key control symbol and "U.S. property - Do not duplicate." Do not place room number on keys.

Furnish seven change keys for each interchangeable core, furnish two control keys, six master keys, and six construction master keys. Furnish a quantity of key blanks equal to 20 percent of the total number of change keys. Stamp each key with appropriate key control symbol and "U.S. property - Do not duplicate." Do not place room numbers on keys. Place room numbers in the key cabinet.

2.3.8 Door Bolts

Performance Requirements

- A. Flush bolts to be forged brass , with diameter bolts. Plunger to be supplied with milled surface one side which fits into a matching guide.

ANSI/BHMA A156.16. Provide dustproof strikes for bottom bolts, except for doors having metal thresholds. Automatic latching flush bolts: ANSI/BHMA A156.3, Type 25.

2.3.9 Closers

For fire doors, meet the standards defined in UL 14C, "Swinging Hardware for Standard Tin-Clad Fire Doors Mounted Singly and in Pairs.

ANSI/BHMA A156.4, Series C02000, Grade 1, with PT 4C. Provide with brackets, arms, mounting devices, fasteners, full size covers, except at storefront mounting, and other features necessary for the particular application. Size closers in accordance with manufacturer's recommendations, or provide multi-size closers, Sizes 1 through 6, and list sizes in the Hardware Schedule. Provide manufacturer's 10 year warranty.

Performance Requirements

- A. All closers are to be mounted on the door rather than the frame.
- B. Closers are to have full rack and pinion hydraulic operation with separate controls for closing and latching speeds.
- C. Closer to have high strength cast iron cylinder and all temperature fluid.
- D. Hydraulic regulation to be controlled by tamper-proof, non-critical screw valves, adjustable with a hex wrench. Separate adjustments for back check, general speed, and latch speed. Use

double-lever arm closers with delay option.

- E. Door closers shall have fully hydraulic, full-rack and pinion action with a high strength cast iron cylinder.
- F. Hydraulic fluid shall be of a type requiring no seasonal closer adjustment for high temperatures ranging from 120 degrees F (49 degrees C) to -30 degrees F (-35 degrees C).
- G. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed and back check.
- H. All closers shall have solid forged steel main arms (and forearms for parallel arm closers) and where specified shall have a cast-in solid stop on the closer shoe ("cush"). Where door travel on out-swing doors must be limited, use "cush" type closers. Auxiliary stops are not required when cushion type closers are used.
- I. All closers shall be certified to exceed ten-million (10,000,000) full load cycles by a recognized independent testing laboratory. All closers (overhead, surface and concealed) shall be of one manufacturer and carry manufacturer's ten-year warranty (electric closers to have two-year warranty).
- J. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ADA and ANSI A-117.1 provisions for door opening force.
- K. Closers to be installed to allow door swing as shown on plans. Doors swinging into exit corridors shall provide for corridor clear width as required by code. Where possible, mount closers inside rooms.
- L. Powder coating finish to be certified to exceed 100 hours salt spray testing by ETL, an independent testing laboratory used by BHMA for ANSI certification. Finish shall be BHMA 689-Aluminum to match remaining hardware.
- M. Coordinate with Frame Manufacturer so slots and reinforcements are placed in head for closer and stops.

2.3.9.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation located to be visible after installation.

2.3.10 Overhead Holders

- A. The overhead holder will be used where there is no way to mount a

stop. Magnetic hold opens are noted in the door schedule and at all fire doors, unless otherwise noted.

- B. The electric door holders shall provide units designed to hold door open in the open condition under normal usage and to release the door automatically under fire conditions.

ANSI/BHMA A156.8.

Performance Requirements

- A. Provide door holders of stainless steel finish (630).

2.3.11 Door Protection Plates

Performance Requirements

- A. Provide manufacturers standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.
- B. Materials:
 - (1) Metal Plates: Stainless steel, 1.6 mm.
- C. Fabricate protection plates not more than 38.1 mm less than door width on hinge side and not more than 15mm less than door width on pull side.
- D. Heights:
 - (1) Kick plates to be 900 mm in height. Use on all doors with closers on push side.
 - (2) Mop plates to be 101.6 mm in height, and shall be located in mopable floor areas.
 - (3) Armor plates to be 914.4 mm in height. Armor plates on fire doors to comply with NFPA 80. Use armor plates on all type (E) doors and others as noted.

ANSI/BHMA A156.6.

2.3.11.1 Sizes of Armor and Kick Plates

Width for single doors shall be 50 mm less than door width; width for pairs of doors shall be 25 mm less than door width. Height of kick plates shall be 250 mm for flush doors and 25 mm less than height of bottom rail for panel doors. Height of armor plates shall be 900 mm unless otherwise noted. Height of mop plates shall be 150 mm.

2.3.12 Door Stops and Silencers

Performance Requirements

A. Refer to Hardware Headings.

ANSI/BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each pair.

2.3.13 Padlocks

ASTM F 883.

2.3.14 Thresholds

Performance Requirements

- A. Where vertical and rod exit devices are used and for other outswinging exterior doors, ANSI/BHMA 156.21, use type J 35100.

ANSI/BHMA A156.21. Use J35100, with vinyl or silicone rubber insert in face of stop, for exterior doors opening out, unless specified otherwise.

2.3.15 Weather Stripping

Performance Requirements

- A. Coordinate with the hollow metal door specification. Do not use interlocking or spring tension type on hollow metal doors and frames.
- B. A set shall include head and jamb seals, sweep strips, and, for pairs of doors, weatherstripping on the inactive second coordinated door. Air leakage of weather stripped doors shall not exceed 2.19×10^{-5} cms per minute of air per square meter of door area when tested in accordance with ASTM E 283. Weatherstripping shall be extruded aluminum retainers.

2.3.16 Lightproofing and Soundproofing

A set shall include adjustable doorstops at head and jambs and an automatic door bottom, both of extruded aluminum, clear (natural) anodized, surface applied, with vinyl fin seals between plunger and housing. Doorstops shall have solid neoprene tube, silicone rubber, or closed-cell sponge gasket. Door bottoms shall have adjustable operating rod and silicone rubber or closed-cell sponge neoprene gasket. Doorstops shall be mitered at corners.

2.3.17 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, required to service and adjust hardware items.

2.4 FASTENERS

Provide fasteners of proper type, quality, size, quantity, and finish with hardware. Fasteners exposed to weather shall be of nonferrous metal or stainless steel. Provide fasteners of type necessary to accomplish a permanent installation.

2.5 FINISHES

ANSI/BHMA A156.18. Hardware shall have BHMA 630 finish (satin stainless steel), unless specified otherwise. Provide items not manufactured in stainless steel in BHMA 626 finish (satin chromium plated) over brass or bronze, except surface door closers which shall have aluminum powder coat paint finish. Interior steel hinges shall have BHMA 652 finish (satin chromium plated). Hinges for exterior doors shall be stainless steel with BHMA 630 finish. Exit devices shall be BHMA 626 finish. Exposed parts of concealed closers shall have finish to match lock and door trim.

2.6 KEY CABINET AND CONTROL SYSTEM

ANSI/BHMA A156.5, Type E8311 (600 hooks).

PART 3 EXECUTION

3.1 INSTALLATION

Install hardware in accordance with manufacturers' printed instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

3.1.1 Weather Stripping Installation

Handle and install weather stripping so as to prevent damage. Provide full contact, weather-tight seals. Doors shall operate without binding.

3.1.1.1 Stop-Applied Weather Stripping

Fasten in place with color-matched sheet metal screws not more than 225 mm o.c. after doors and frames have been finish painted.

3.1.2 Lightproofing and Soundproofing Installation

Install as specified for stop-applied weather stripping.

3.1.3 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws in expansion sleeves.

3.2 FIRE DOORS AND EXIT DOORS

Install hardware in accordance with NFPA 80 for fire doors, NFPA 101 for exit doors.

3.3 HARDWARE LOCATIONS

ANSI/SDI 100, unless indicated or specified otherwise.

- a. Kick and Armor Plates: Push side of single-acting doors. Both sides of double-acting doors.
- b. Mop Plates: Bottom flush with bottom of door.

3.4 KEY CABINET AND CONTROL SYSTEM

Locate where directed. Tag one set of file keys and one set of duplicate keys. Place other keys in appropriately marked envelopes, or tag each key.

Furnish complete instructions for setup and use of key control system. On tags and envelopes, indicate door and room numbers or master or grand master key.

3.5 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, as directed, errors in cutting and fitting and damage to adjoining work.

3.6 HARDWARE SETS

LIST OF HARDWARE SETS

HW-1 (EACH PAIR TO HAVE:)

EACH PAIR TO HAVE:

2	CONTINUOUS HINGES	A156.2 2000 FULL MORTISE X FOR POWER TRANSFER
1	ELECTRIC EXIT DEVICE	EL-GR 1, TYPE 8, FUNC 05
1	ELECTRIC EXIT DEVICE	EL-GR 1, TYPE 8, FUNC 01
1	CYLINDER	EO9211 (RC)
2	POWER TRANSFERS	A156.23/E00001
1	POWER SUPPLY	A156.23/E00001
1	CARD READER	Reference Section 13210
2	PULLS	J401-10
2	OPERATORS	A156.19
2	ACTUATORS	A156.19
2	OVERHEAD STOPS	C51541
1	THRESHOLD	J32103
1	SET DOOR SEALS	BY FRAME MANUFACTURER
2	DOOR BOTTOM SEALS	BY DOOR MANUFACTURER
1	ASTRAGAL SET	BY DOOR MANUFACTURER
2	DOOR POSITION SWITCHES	A156.23/E00001

NOTES: COORDINATE INSTALLATION OF ELECTRICAL AND SECURITY HARDWARE WITH ELECTRICAL AND SECURITY SYSTEMS.

HW-2

EACH PAIR TO HAVE:

2	CONTINUOUS HINGES	A156.2 2000 FULL MORTISE
2	PUSH PULL SETS	J504
2	OPERATORS	A156.19
2	ACTUATORS	A156.19
2	OVERHEAD STOPS	C51541

NOTES: COORDINATE INSTALLATION OF ELECTRICAL HARDWARE WITH ELECTRICAL SYSTEM.

HW-3

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112/A8111
1	LOCKSET	F07
1	CYLINDER	E09211 (RC)
1	ELECTRIC STRIKE	E09313
1	POWER SUPPLY	A156.23/E00001
1	CARD READER	Reference Section 13210
1	CLOSER	C72021 PT4C, D, G
1	KICK PLATE	J102 10 X 2 LDW
1	DOOR POSITION SWITCH	A156.23/E00001

NOTES: COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SECURITY SYSTEMS.

HW-4

EACH PAIR TO HAVE:

1	CONTINUOUS HINGE	A156.2 2000 FULL MORTISE X CUT FOR POWER TRANSFER
1	CONTINUOUS HINGE	A156.2 2000 FULL MORTISE
1	ELECTRIC EXIT DEVICE	EL-GR 1, TYPE 8, FUNC 05
1	EXIT DEVICE	GR 1, TYPE 8, FUNC 01
1	CYLINDER	E09211 (RC)
1	POWER TRANSFER	A156.23/E00001
1	POWER SUPPLY	A156.23/E00001
1	CARD READER	Reference Section 13210
2	PULLS	J401-10
2	OHC CLOSERS	C75032 PT 8A, D, F
2	WALL BUMPERS	L12101
2	DOOR POSITION SWITCHES	A156.23/E0001

NOTES: COORIDINATE INSTALLATION OF ELECTRICAL AND SECURITY HARDWARE WITH ELECTRICAL, SECURITY AND FIRE SYSTEMS.

HW-5

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112
1	LOCKSET	F04
1	CYLINDER	E09211 (RC)
1	WALL BUMPER	L12101
1	THRESHOLD	J12303
1	SET DOOR SEALS	R3C265
1	AUTO DOOR BOTTOM SEAL	R3E325

HW-6

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112
1	DUMMY TRIM	F00
1	ROLLER LATCH	E19091
1	WALL BUMPER	L12101

HW-7

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112
1	LOCKSET	F04
1	CYLINDER	E09211 (RC)
1	WALL BUMPER	L12101

HW-8

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112/A8111
1	LOCKSET	F07
1	CYLINDER	E09211 (RC)
1	ELECTRIC STRIKE	E09323
1	POWER SUPPLY	A156.23/E00001
1	CARD READER	Reference Section 13210
1	CLOSER	C72011 PT 4C, D, H
1	OVERHEAD STOP	C54541
1	KICK PLATE	J102 10 X 2 LDW
1	DOOR POSITION SWITCH	A156.23/E00001

NOTES: COORDINATE SECURITY AND ELECTRICAL HARDWARE WITH
SECURITY AND ELECTRICAL SYSTEMS.

HW-9

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112
1	LOCKSET	F07
1	CYLINDER	E09211 (RC)
1	WALL BUMPER	L12101

HW-10

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	CLOSER	C72011 PT 4C, D, H
1	OVERHEAD STOP	C54541
1	KICK PLATE	J102 10 X 2 LDW

HW-11

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112/A8111
1	LOCKSET	F07
1	CYLINDER	E09211 (RC)
1	CLOSER	C72011/C72021 PT 4C, D, H
1	KICK PLATE	J102 10 X 2 LDW
1	WALL BUMPER	L12101

HW-12

EACH DOOR TO HAVE:

3	PAIR HINGES	A8111
1	EXIT DEVICE	GR 1. TYPE 1, FUNC 03
1	CYLINDER	E09211 (RC)
1	PULL	J401-10
1	CLOSER	C72021 PT 4C, D, G
1	KICK PLATE	J102 10 X 2 LDW
1	SET DOOR SEALS	R0E165
1	DOOR BOTTOM SEAL	R3A315

HW-13

EACH PAIR TO HAVE:

3	PAIR HINGES	A8112
1	SET FLUSHBOLTS	L14081 X L14021
1	DEAD LOCK	F18

HW-14

EACH PAIR TO HAVE:

3	PAIR HINGES	A8111
1	EXIT DEVICE	GR 1, TYPE 8, FUNC 03
1	EXIT DEVICE	GR 1, TYPE 8, FUNC 01
1	CYLINDER	E09211 (RC)
2	PULLS	J401-10
2	CLOSERS	C72021 PT 4C, D, G

2 KICK PLATES J102 10 X 2 LDW

HW-15

EACH DOOR TO HAVE:

1	CONTINUOUS HINGE	A156.2 2000 FULL MORTISE X CUT FOR POWER TRANSFER
1	ELECTRIC EXIT DEVICE	EL-FR 1, TYPE 1, FUNC 03
1	CYLINDER	E09211
1	POWER TRANSFER	A156.23/E00001
1	POWER SUPPLY	A156.23/E00001
1	CARD READER	Reference Section 13210
1	PULL	J401-10
1	OHC CLOSER	C75032 PR 8A, D, F X ST
1	OVERHEAD STOP	C53541
1	THRESHOLD	J32103
1	SET DOOR SEALS	BY FRAME MANUFACTURER -
1	DOOR BOTTOM SEAL	BY DOOR MANUFACTURER -
1	DOOR POSITION SWITCH	A156.23/E00001

NOTES: COORDINATE INSTALLATION OF SECURITY AND ELECTRICAL HARDWARE WITH
SECURITY AND ELECTRICAL SYSTEMS.

HW-16

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112/A8111
1	LOCKSET	F05
1	CYLINDER	E09211 (RC)
1	CLOSER	C72011/C72021 PT 4C, D, H
1	KICK PLATE	J102 10 X 2 LDW
1	WALL BUMPER	L12101

HW-17

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8111
1	PUSH	J301 4 X 16
1	PULL	J405 4 X 16
1	CLOSER	C72021 PT 4C, D, G
1	KICK PLATE	J102 10 X 2 LDW

HW-18

EACH DOOR TO HAVE:

1	PAIR HINGES	A5111 X NRP
1	ELECTRIC HINGE	EL-A5111 X ETW-4
1	MORTAR GUARD	A156.23/E00001
1	ELECTRIC LOCKSET	EL-F07-MOD
1	CYLINDER	E09211 (RC)

1	POWER SUPPLY	A156.23/E00001
1	CARD READER	Reference Section 13210
1	CLOSER	C72021 PT 4C, D, G
1	THRESHOLD	J32103
1	SET DOOR SEALS	R3E165
1	DOOR BOTTOM SEAL	R3E435
1	DOOR POSITION SWITCH	A156.23/E00001

NOTES: COORDINATE INSTALLATION OF SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

HW-19

EACH PAIR TO HAVE:

3	PAIR HINGES	A8112/A8111
1	SET FLUSHBOLTS	L14081 X L14021
1	LOCKSET	F07
1	CYLINDER	E09211 (RC)
1	CLOSER	C72011/C72021 PT 4C, D, H
2	WALL BUMPERS	L12101

HW-20

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8111
1	PASSAGE SET	F01
1	CLOSER	C72021 PT 4C, D, G
1	KICK PLATE	J102 10 X 2 LDW
1	THRESHOLD	J12303
1	SET DOOR SEALS	R3C265
1	AUTO DOOR BOTTOM SEAL	R3E325

HW-21

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8111
1	PASSAGE SET	F13
1	CLOSER	C72021 PT 4C, D, G
1	KICK PLATE	J102 10 X 2 LDW

HW-22

EACH PAIR TO HAVE:

1	CONTINUOUS HINGE	A156.2 2000 FULL MORTISE X CUT FOR POWER TRANSFER
1	CONTINUOUS HINGE	A156.2 2000 FULL MORTISE
1	ELECTRIC EXIT DEVICE	EL-GR 1, TYPE 8, FUNC 05
1	EXIT DEVICE	GR 1, TYPE 8, FUNC 01
1	CYLINDER	E09211 (RC)
1	POWER TRANSFER	A156.23/E00001

1	POWER SUPPLY	A156.23/E00001
1	CARD READER	Reference Section 13210
2	PULLS	J401-10
2	OHC CLOSERS	C75032 PT 8A, D, F X ST
2	OVERHEAD STOPS	C53541 X SP/LO
1	THRESHOLD	J32103
1	SET DOOR SEALS	BY FRAME MANUFACTURER
2	DOOR BOTTOM SEALS	BY DOOR MANUFACTURER
1	ASTRAGAL SET	BY DOOR MANUFACTURER
2	DOOR POSITION SWITCHES	A156.23/E00001

NOTES: COORDINATE INSTALLATION OF ELECTRICAL AND SECURITY HARDWARE
WITH ELECTRICAL AND SECURITY SYSTEMS.

HW-23

EACH PAIR TO HAVE:

2	CONTINUOUS HINGES	A156.2 2000 FULL MORTISE
2	PUSH PULL SETS	J504
2	OHC CLOSER	C75032 PT 8A, D, F
2	FLOOR STOPS	L12131

HW-24

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112/A8111
1	LOCKSET	F07
1	CYLINDER	E09211 (RC)
1	ELECTRIC STRIKE	E09323
1	POWER SUPPLY	A156.23/E00001
1	CARD READER	Reference Section 13210
1	CLOSER	C72011 PT 4C, D, H
1	KICK PLATE	J102 10 X 2 LDW
1	WALL BUMPER	L12101
1	DOOR POSITION SWITCH	A156.23/E00001

NOTES: COORDINATE SECURITY AND ELECTRICAL HARDWARE WITH SECURITY AND
ELECTRICAL SYSTEMS.

HW-25

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112
1	PASSAGE SET	F01
1	CLOSER	C72011/C72021 PT 4C, D, H
1	WALL BUMPER	L12101

HW-26

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8111
1	LOCKSET	F07
1	CYLINDER	E09211 (RC)
1	ELECTRIC STRIKE	E09323
1	POWER SUPPLY	A156.23/E00001
1	CARD READER	Reference Section 13210
1	CLOSER	C72021 PT 4C, D, G
1	KICK PLATE	J102 10 X 2 LDW
1	THRESHOLD	J12303
1	SET DOOR SEALS	R3C265
1	AUTO DOOR BOTTOM	R3E325
1	DOOR POSITION SWITCH	A156.23/E00001

NOTES: COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SECURITY SYSTEMS.

HW-27

EACH PAIR TO HAVE:

3	PAIR HINGES	A8112/A8111
1	SET AUTO FLUSHBOLTS	A156.3, TYPE 25
1	DUST PROOF STRIKE	L14021
1	COORDINATOR	A156.3, TYPE 21
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	TRIM PROTECTOR	J200
2	CLOSERS	C72021 PT 4C, D, G
2	KICK PLATES	J102 10 X 2 LDW

HW-28

EACH DOOR TO HAVE:

NOTES: ALL HARDWARE BY VAULT MANUFACTURER.

HW-29

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112
1	LOCKSET	F05
1	CYLINDER	E09211 (RC)
1	WALL BUMPER	L12101

HW-30

EACH PAIR TO HAVE:

2-1/2	PAIR HINGES	A8112
1	ELECTRIC HINGE	EL-A8112 X ETW-4
1	MORTAR GUARD	A156.23/E00001
1	SET FLUSHBOLTS	L14081 X L14021
1	ELECTRIC LOCKSET	EL-FO7 MOD

1	CYLINDER	E09211 (RC)
1	POWER SUPPLY	A156.23/E00001
1	CARD READER	Reference Section 13210
1	CLOSER	C72011 PT 4C, D, H
2	OVERHEAD STOPS	C54541
2	KICK PLATES	J102 10 X 2 LDW
2	DOOR POSITION SWITCHES	A156.23/E00001

NOTES: COORDINATE INSTALLATION OF SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

HW-31

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112/A8111
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	KICK PLATE	J102 10 X 2 LDW
1	WALL BUMPER	L12101

HW-32

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112/A8111
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	CLOSER	C72011 PT 4C, D, H
1	KICK PLATE	J102 10 X 2 LDW
1	WALL BUMPER	L12101

HW-33

EACH PAIR TO HAVE:

3	PAIR HINGES	A8112/A8111
1	SET FLUSHBOLTS	L14081 X L14021
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	LOCK PROTECTOR	J200
1	CLOSER	C72021 PT 4C, D, H X 180°
2	KICK PLATES	J102 10 X 2 LDW
2	WALL BUMPERS	L12101

HW-34

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112/A8111
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	CLOSER	C72021 PT 4C, D, G
1	KICK PLATE	J102 10 X 2 LDW

HW-35

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A5112 X NRP
1	LOCKSET	F07
1	CYLINDER	E09211 (RC)
1	CLOSER	C72021 PT 4C, D, G
1	THRESHOLD	J32103
1	SET DOOR SEALS	R3E165
1	DOOR BOTTOM SEAL	R3E435
1	DRIP CAP	R3Y005
1	DOOR POSITION SWITCH	A156.23/E00001

NOTES: COORDINATE INSTALLATION OF SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

HW-36

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	CLOSER	C72011 PT 4C, D, H
1	KICK PLATE	J102 10 X 2 LDW
1	FLOOR STOP	L12131
1	SET DOOR SEALS	R3C265
1	AUTO DOOR BOTTOM	R3E325

HW-37

EACH PAIR TO HAVE:

2-1/2	PAIR HINGES	A8112
1	ELECTRIC HINGE	EL-A8112 X ETW-4
1	MORTAR GUARD	A156.23/E00001
1	AUTO FLUSHBOLTS	A156.3, TYPE 25
1	DUST PROOF STRIKE	L14021
1	COORDINATOR	A156.3, TYPE21
1	ELECTRIC LOCKSET	EL-F07 MOD
1	CYLINDER	E09211 (RC)
1	POWER SUPPLY	A156.23/E00001
1	CARD READER	Reference Section 13210
2	CLOSERS	C72021 PT 4C, D, G
2	KICK PLATES	J102 10 X 2 LDW
1	THRESHOLD	J12303
1	SET DOOR SEALS	R3C265
2	DOOR BOTTOM SEALS	R3B345
1	ASTRAGAL SET	BY DOOR MANUFACTURER
2	DOOR POSITION SWITCHES	A156.23/E00001

NOTES: COORDINATE INSTALLATION OF SECURITY HARDWARE WITH SECURITY AND

ELECTRICAL SYSTEMS.

HW-38

EACH PAIR TO HAVE:

2-1/2	PAIR HINGES	A8112
1	ELECTRIC HINGE	EL-A8112 X ETW-4
1	MORTAR GUARD	A156.23/E00001
1	SET FLUSHBOLTS	L14081 X L14021
1	ELECTRIC LOCKSET	EL-F07 MOD
1	CYLINDER	E09211 (RC)
1	POWER SUPPLY	A156.23/E00001
1	CARD READER	Reference Section 13210
1	CLOSER	C72021 PT4C, D, G
2	KICK PLATES	J102 10 X 2 LDW
1	THRESHOLD	J12303
1	SET DOOR SEALS	R3C265
2	AUTO DOOR BOTTOM SEALS	R3B345
1	ASTRAGAL SET	BY DOOR MANUFACTURER
2	DOOR POSITION SWITCHES	A156.23/E00001

NOTES: COORDINATE INSTALLATION OF SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

HW-39

EACH PAIR TO HAVE:

3	PAIR HINGES	A8112
1	SET FLUSHBOLTS	L14081 X L14021
1	PASSAGE SET	F01
1	CYLINDER	E09211
1	CLOSER	C72051 PT 4C, D, H
2	KICK PLATES	J102 10 X 2 LDW
2	WALL BUMPERS	L12101
1	ASTRAGAL SET	BY DOOR MANUFACTURER

HW-40

EACH DOOR TO HAVE:

1	MAG LOCK	E08501 X MBS X DSM
1	POWER SUPPLY	A156.23/E00001
1	SCANNER	A156.23/E00001
1	REQUEST TO EXIT BUTTON	A156.23/E00001
1	CARD READER	BY OTHERS

NOTES: BALANCE OF HARDWARE BY DOOR MANUFACTURER. COORDINATE INSTALLATION OF ELECTRICAL AND SECURITY HARDWARE WITH ELECTRICAL, SECURITY AND FIRE SYSTEMS.

HW-41

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112/A8111
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	OVERHEAD HOLDER	C55511
1	KICK PLATE	J102 10 X 2 LDW

HW-42

EACH DOOR TO HAVE:

1	CYLINDER	E09211 (RC)
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HW-43

EACH DOOR TO HAVE:

1	DOOR POSITION SWITCH	A156.23/E00001
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NOTES: COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.
BALANCE OF HARDWARE BY DOOR MANUFACTURER.

HW-44

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	OVERHEAD STOP	C55511
1	KICK PLATE	J102 10 X 2 LDW
1	THRESHOLD	J12303
1	SET DOOR SEALS	R3C265
1	AUTO DOOR BOTTOM	R3E325

HW-45

EACH PAIR TO HAVE:

3	PAIR HINGES	A8112
1	SET FLUSHBOLTS	L14081 X L14021
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	OVERHEAD STOP	C55511
1	WALL BUMPER	L12101
2	KICK PLATES	J102 10 X 2 LDW
1	THRESHOLD	J12303
1	SET DOOR SEALS	R3C265
2	AUTO DOOR BOTTOMS	R3B345
1	ASTRAGAL SET	BY DOOR MANUFACTURER

HW-46

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	CLOSER	C72021 PT 4C, D, G
1	KICK PLATE	J102 10 X 2 LDW
1	THRESHOLD	J12303
1	SET DOOR SEALS	R3C265
1	AUTO DOOR BOTTOM	R3E325
1	DOOR POSITION SWITCH	A156.23/E00001

NOTES: COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

HW-47

EACH PAIR TO HAVE:

3	PAIR HINGES	A8112
1	SET FLUSHBOLTS	L14081 X L14021
1	LOCKSET	F07
1	CYLINDER	E09211(RC)
2	OVERHEAD HOLDERS	C55541

HW-48

EACH PAIR TO HAVE:

2-1/2	PAIR HINGES	A8112
1	ELECTRIC HINGE	EL-A8112 X ETW-4
1	MORTAR GUARD	A156.23/E00001
1	SET FLUSHBOLTS	L14081 X L14021
1	ELECTRIC LOCKSET	EL-FO7 MOD
1	CYLINDER	E09211 (RC)
1	POWER SUPPLY	A156.23/E00001
1	CARD READER	Reference Section 13210
1	CLOSER	C72011 PT 4C, D H
1	OVERHEAD STOP	C54541
1	WALL BUMPER	L12101
2	KICK PLATES	J102 10 X 2 LDW
2	DOOR POSITION SWITCHES	A156.23/E00001

NOTES: COORDINATE INSTALLATION OF SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

HW-49

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	WALL BUMPER	L12101

1	KICK PLATE	J102 10 X 2 LDW
1	THRESHOLD	J12303
1	SET DOOR SEALS	R3C265
1	AUTO DOOR BOTTOM	R3E325

HW-50

EACH PAIR TO HAVE:

3	PAIR HINGES	A8112
1	SET FLUSHBOLTS	L14081 X L14021
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	CLOSER	C72021 PT 4 C, D, G
2	KICK PLATES	J102 10 X 2 LDW
1	THRESHOLD	J12303
1	SET DOOR SEALS	R3C265
2	AUTO DOOR BOTTOMS	R3B345
1	ASTRAGAL SET	BY DOOR MANUFACTURER
2	DOOR POSITION SWITCHES	A156.23/E00001

NOTES: COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

HW-51

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	CLOSER	C72011 PT 4C, D, H
1	KICK PLATE	J102 10 X 2 LDW
1	WALL BUMPER	L12101
1	THRESHOLD	J12303
1	SET DOOR SEALS	R3C265
1	AUTO DOOR BOTTOM	R3E325

HW-52

1-1/2	PAIR HINGES	A8112
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	CLOSER	C72021 PT 4 C, D, G
1	KICK PLATE	J102 10 X 2 LDW
1	THRESHOLD	J12303
1	SET DOOR SEALS	R3C265
1	AUTO DOOR BOTTOM	R3E325

HW-53

3	PAIR HINGES	A8112
1	SET AUTO FLUSHBOLTS	A156.3, F25
1	DUST PROOF STRIKE	L14021
1	COORDINATOR	A156.3, F23

1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
2	CLOSERS	C72021 PT 4 C, D G
2	KICK PLATES	J102 10 X 2 LDW
1	THRESHOLD	J12303
1	SET DOOR SEALS	R3C265
2	AUTO DOOR BOTTOMS	R3B345
1	ASTRAGAL SET	BY DOOR MANUFACTURER

HW-54

EACH PAIR TO HAVE:

3	PAIR HINGES	A8112
1	SET FLUSHBOLTS	L14081 X L14021
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	CLOSER	C72011 PT 4 C, D, H
2	KICK PLATES	J102 10 X 2 LDW
2	WALL BUMPERS	L12101
1	THRESHOLD	J12303
1	SET DOOR SEALS	R3C265
2	AUTO DOOR BOTTOMS	R3B345
1	ASTRAGAL SET	BY DOOR MANUFACTURER

HW-55

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8112
1	PRIVACY SET	F22
1	WALL BUMPER	L12101

HW-56

EACH DOOR TO HAVE:

1	CYLINDER	E09211 (RC) (OR PADLOCK AS REQUIRED)
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NOTES: BALANCE OF HARDWARE BY OVERHEAD DOOR COMPANY.

HW-57

EACH PAIR TO HAVE:

3	PAIR HINGES	A8112
1	SET FLUSHBOLTS	L14081 X L14021
1	LOCKSET	F04
1	CYLINDER	E09211 (RC)
1	CLOSER	C72021 PT 4 C, D, G
2	KICK PLATES	J102 10 X 2 LDW
1	WALL BUMPER	L12101

HW-58

EACH DOOR TO HAVE:

2	PAIR HINGES	A8112
1	FLUSHBOLT	L14081 (MOUNT AT DOOR EDGE)
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	WALL STOP & HOLDER	L11302
1	FLOOR STOP & HOLDER	L11291
1	KICK PLATE	J102 10 X 2 LDW
1	DOOR POSITION SWITCH	A156.23/E00001

NOTES: COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

HW-59

EACH PAIR TO HAVE:

2	CONTINUOUS HINGES	A156.2 2000 FULL MORTISE
1	EXIT DEVICE	GR 1, TYPE 8, FUNC 03
1	EXIT DEVICE	GR 1, TYPE 8, FUNC 01
1	CYLINDER	E09211 (RC)
2	PULLS	J401-10
2	CLOSERS	C72051 PT 4 C, D, F, H
1	THRESHOLD	J32103
1	SET DOOR SEALS	R3E165
2	DOOR BOTTOM SEAL	R3E435
1	ASTRAGAL SET	R3E035
2	DOOR POSITION SWITCHES	A156.23/E00001

NOTES: COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

HW-60

EACH PAIR TO HAVE:

3	PAIR HINGES	A8111
1	EXIT DEVICE	GR 1, TYPE 8, FUNC 03 X LBR
1	EXIT DEVICE	GR 1, TYPE 8, FUNC 01 X LBR
1	CYLINDER	E09211 (RC)
2	PULLS	J401-10
2	CLOSERS	C72021 PT 4 C, D, G
2	KICK PLATES	J102 10 X 2 LDW
1	THRESHOLD	J32103
1	SET DOOR SEALS	R3C265
2	AUTO DOOR BOTTOM SEALS	R3B345
1	ASTRAGAL SET	R3E035

NOTES: COORDINATE SECURITY AND ELECTRICAL HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

HW-61

EACH PAIR TO HAVE:

3	PAIR HINGES	A8111
2	ELECTRIC EXIT DEVICES	EL-GR 1, TYPE 8, FUNC 08
2	CYLINDERS	E09211 (RC)
2	POWER TRANSFERS	A156.23/E00001
1	POWER SUPPLY	A156.23/E00001
1	CARD READER	Reference Section 13210
2	PULLS	J401-10
2	CLOSERS	C72021 PT 4 C, D, G
2	KICK PLATES	J102 10 X 2 LDW
1	THRESHOLD	J32103
1	SET DOOR SEALS	R3C265
2	DOOR BOTTOM SEALS	R3B345
1	ASTRAGAL SET	R3E035
2	DOOR POSITION SWITCHES	A156.23/E00001

NOTES: COORDINATE SECURITY AND ELECTRICAL HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

HW-62

EACH DOOR TO HAVE:

3	PAIR HINGES	A8111
2	PUSHES	J301 4 X 16
2	PULLS	J405 4 X 16
2	CLOSERS	C72021 PT 4 C, D, G
2	KICK PLATES	J102 10 X 2 LDW

NOTES: BALANCE OF HARDWARE BY SLIDING DOOR MANUFACTURER. COORDINATE SECURITY AND ELECTRICAL HARDWARE WITH SECURITY, ELECTRICAL AND FIRE SYSTEMS.

HW-63

EACH PAIR TO HAVE:

1	CONTINUOUS HINGE	A156.2 2000 FULL MORTISE X CUT FOR POWER TRANSFER
1	CONTINUOUS HINGE	A156.2 2000 FULL MORTISE
1	ELECTRIC EXIT DEVICE	EL-GR 1, TYPE 8, FUNC 03
1	EXIT DEVICE	GR 1, TYPE 8, FUNC 01
1	CYLINDER	E09211 (RC)
1	POWER TRANSFER	A156.23/E00001
1	POWER SUPPLY	A156.23/E00001
1	CARD READER	Reference Section 13210
2	PULLS	J401-10
2	CLOSERS	C72051 PT 4 C, D, F, H
2	KICK PLATES	J102 10 X 2 LDW
1	THRESHOLD	J32103
1	SET DOOR SEALS	R3C265
2	DOOR BOTTOM SEALS	R3B345
1	ASTRAGAL SET	R3E035
2	DOOR POSITION SWITCHES	A156.23/E00001

NOTES: COORDINATE SECURITY AND ELECTRICAL HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

HW-64

EACH DOOR TO HAVE:

1	CYLINDER	E09211 (RC) (OR PADLOCK AS REQUIRED)
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NOTES: BALANCE OF HARDWARE BY DOOR MANUFACTURER.

HW-65

EACH PAIR TO HAVE:

2	DOOR POSITION SWITCHES	A156.23/E00001
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NOTES: COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

HW-66

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8111
1	PUSH	J301 4 X 16
1	PULL	J405 4 X 16
1	CLOSER	C72011 PT 4 C, D, H
1	KICK PLATE	J102 10 X 2 LDW
1	WALL BUMPER	L12101

HW-67

EACH DOOR TO HAVE:

2	PAIR HINGES	A8111
1	FLUSHBOLT	L14081 (MOUNT AT DOOR EDGE)
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	OVERHEAD HOLDER	C54511
1	FLOOR STOP & HOLDER	L11291
1	KICK PLATE	J102 10 X 2 LDW

HW-68

EACH PAIR TO HAVE:

3	PAIR HINGES	A8111
1	SET AUTO FLUSHBOLTS	A156.3, F25
1	DUST PROOF STRIKE	L14021
1	COORDINATOR	A156.3, F23
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
2	CLOSERS	C72021 PT 4 C, D, G
2	KICK PLATES	J102 10 X 2 LDW

HW-69

EACH PAIR TO HAVE:

3	PAIR HINGES	A8111
1	SET AUTO FLUSHBOLTS	A156.3, F25
1	DUST PROOF STRIKE	L14021
1	COORDINATOR	A156.3, F23
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
2	CLOSERS	C72011 PT 4 C, D, H
2	KICK PLATES	J102 10 X 2 LDW
2	WALL BUMPERS	L12101
1	THRESHOLD	J12303
1	SET DOOR SEALS	R3C265
2	AUTO DOOR BOTTOMS	R3B345
1	ASTRAGAL SET	BY DOOR MANUFACTURER

HW-70

EACH PAIR TO HAVE:

3	PAIR HINGES	A5112 X NRP
1	SET FLUSHBOLTS	L14081
1	LOCKSET	F13
1	CYLINDER	E09211 (RC)
1	CLOSER	C72051 PT 4 C, D, F, H
1	THRESHOLD	J32103
1	SET DOOR SEALS	R3E165
2	DOOR BOTTOM SEALS	R3E435
1	ASTRAGAL SET	BY DOOR MANUFACTUER
2	DOOR POSITION SWITCHES	A156.23/E00001

NOTES: COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

HW-71

EACH PAIR TO HAVE:

3	PAIR HINGES	A5112 X NRP
1	SET FLUSHBOLTS	L14081
1	LOCKSET	F07
1	CYLINDER	E09211 (RC)
1	CLOSER	C72051 PT 4 C, D, F, H
1	THRESHOLD	J32103
1	SET DOOR SEALS	R3E165
2	DOOR BOTTOM SEALS	R3E435
1	ASTRAGAL SET	BY DOOR MANUFACTUER
2	DOOR POSITION SWITCHES	A156.23/E00001

NOTES: COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

HW-72

EACH DOOR TO HAVE:

1-1/2	PAIR HINGES	A8111
1	PASSAGE SET	F01
1	CLOSER	C72011 PT 4C, D, H
1	KICK PLATE	J102 10 X 2 LDW
1	WALL BUMPER	L12101

HW-73

1-1/2	PAIR HINGES	A8112
1	LOCKSET	F07
1	CYLINDER	E09211 (RC)
1	CLOSER	C72021 PT 4C, D, H
1	DOOR POSITION SWITCH	A156.23/E00001

NOTES: COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS.

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SECTION 08810

GLASS AND GLAZING

05/97

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SECTION 08810

GLASS AND GLAZING

05/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1984; R 1994) Safety Performance
Specifications and Methods of Test for
Safety Glazing Materials Used in Buildings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509 (1994) Elastomeric Cellular Preformed
Gasket and Sealing Material

ASTM C 669 (1995) Glazing Compounds for Back Bedding
and Face Glazing of Metal Sash

ASTM C 864 (1999) Dense Elastomeric Compression Seal
Gaskets, Setting Blocks, and Spacers

ASTM C 920 (1998) Elastomeric Joint Sealants

ASTM C 1036 (1997) Flat Glass

ASTM C 1048 (1997b) Heat-Treated Flat Glass - Kind HS,
Kind FT Coated and Uncoated Glass

ASTM C 1172 (1996) Laminated Architectural Flat Glass

ASTM D 395 (1998) Rubber Property - Compression Set

ASTM E 119 (1998) Fire Tests of Building Construction
and Materials

ASTM E 773 (1997) Accelerated Weathering of Sealed
Insulating Glass Units

ASTM E 774 (1997) Classification of the Durability of
Sealed Insulating Glass Units

ASTM E 1300 (1998) Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (1995) Minimum Design Loads for Buildings and Other Structures

CODE OF FEDERAL REGULATIONS (CFR)

16 CFR 1201 Safety Standard for Architectural Glazing Materials

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual (1997) Glazing Manual

GANA Standards Manual (1995) Engineering Standards Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1999) Fire Doors and Fire Windows

NFPA 252 (1995) Fire Tests of Door Assemblies

NFPA 257 (1996) Fire Tests for Window and Glass Block Assemblies

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation

Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, materials, and types and thickness of glass.

Provide full finalized design/construction drawings of the artwork located in the lobby.

SD-03 Product Data

Insulating Glass Glazing Accessories

Manufacturer's descriptive product data, handling and storage

recommendations, installation instructions, and cleaning instructions.

SD-04 Samples

Insulating Glass

Two 203 x 254 mm samples of all exterior glass.

SD-07 Certificates

Insulating Glass

Certificates stating that the glass meets the specified requirements. Labels or manufacturers marking affixed to the glass will be accepted in lieu of certificates.

1.3 SYSTEM DESCRIPTION

1.3.1 Glass Products

1. Type A: 26 mm Clear Laminated Insulating: Where this designation is indicated, provide glass products that meet the following requirements. If not indicated, temper or heat-strengthen as recommended by glass manufacturer or where required to meet building codes having jurisdiction.
 - a. Overall Unit Thickness: 26 mm
 - b. Interspace Content: Air
 - c. Outdoor Lite: 6 mm Clear Tempered
 - d. Indoor Lite: 7 mm Clear Annealed Laminated utilizing .060 clear thickness innerlayer
 - e. Visible Light Transmittance: .79
 - f. Winter U-Value: .47
 - g. Summer U-Value: .55
 - h. Outdoor Visible Reflectance: .14
 - i. Shading Coefficient: .80
2. Type B: 26 mm Green Laminated Insulating: Where this designation is indicated, provide glass products that met the following requirements. If not indicated, temper or heat-strengthen as recommended by glass manufacturer or where required to meet building codes having jurisdiction.
 - a. Overall Unit Thickness: 26 mm
 - b. Interspace Content: Air
 - c. Outdoor Lite: 6 mm Light Green Tempered
 - d. Indoor Lite: 7 mm Clear Annealed Laminated utilizing .060 clear thickness innerlayer
 - e. Visible Light Transmittance: .68
 - f. Winter U-Value: .47
 - g. Summer U-Value: .55
 - h. Outdoor Visible Reflectance: .11
 - i. Shading Coefficient: .54

3. Type C: 25 mm Dark Green Laminated Insulating: Where this designation is indicated, provide glass products that meet the following requirements. If not indicated, temper or heat-strengthen as recommended by glass manufacturer or where required to meet building codes having jurisdiction.
 - a. Overall Unit Thickness: 25 mm
 - b. Interspace Content: Air
 - c. Outdoor Lite: 6 mm Dark Green Tempered
 - d. Indoor Lite: 7 mm White Annealed Laminated utilizing .060 white thickness innerlayer
 - e. Visible Light Transmittance: .44
 - f. Winter U-Value: .45
 - g. Summer U-Value: .55
 - h. Outdoor Visible Reflectance: .12
 - i. Shading Coefficient: .40
4. Type D: 25 mm Dark Green Insulated: Where this designation is indicated, provide glass products that meet the following requirements. If not indicated, temper or heat-strengthen as recommended by glass manufacturer or where required to meet building codes having jurisdiction.
 - a. Overall Unit Thickness: 25 mm
 - b. Interspace Content: Air
 - c. Outdoor Lite: 6 mm Dark Green Tempered
 - d. Indoor Lite: 6 mm Clear Tempered with Charcoal Gray Frit on the 4th Surface
 - e. Visible Light Transmittance: .06
 - f. Winter U-Value: .48
 - g. Summer U-Value: .56
 - h. Outdoor Visible Reflectance: .24
 - i. Shading Coefficient: .31
5. Type E: 6 mm Clear Tempered: Where this designation is indicated, provide glass products that meet the following requirements. If not indicated, temper or heat-strengthen as recommended by glass manufacturer or where required to meet building codes having jurisdiction.
 - a. Visible Light Transmittance: .88
 - b. Winter U-Value: 1.09
 - c. Summer U-Value: 1.03
 - d. Outdoor Visible Reflectance: .08
 - e. Shading Coefficient: .96
6. Type F: 6 mm clear annealed wire glass, located Interior Hollow Metal.
7. Type G: 27 mm Green Laminated Insulated: Where this designation is indicated, provide glass products that meet the following requirements. If not indicated, temper or heat-strengthen as recommended by glass manufacturer or where required to meet

building codes having jurisdiction.

- a. Overall Unit Thickness: 27 mm
 - b. Interspace Content: Air
 - c. Outdoor Lite: 6 mm Light Green Tempered
 - d. Indoor Lite: 11 mm Clear Annealed Laminated utilizing .060 clear thickness innerlayer
 - e. Visible Light Transmittance: .67
 - f. Winter U-Value: .47
 - g. Summer U-Value: .56
 - h. Outdoor Visible Reflectance: .11
 - i. Shading Coefficient: .52
8. Type H: 12 mm Clear Tempered: Where this designation is indicated, provide glass products that meet the following requirements. If not indicated, temper or heat-strengthen as recommended by glass manufacturer or where required to meet building codes having jurisdiction.
- a. Visible Light Transmittance: .84
 - b. Winter U-Value: 1.04
 - c. Summer U-Value: 1.01
 - d. Outdoor Visible Reflectance: .07
 - e. Shading Coefficient: .87

1.3.2 Other Glass

9. Type K, Bullet Resistant Glass. Refer to other Division 8 Sections for security glazing.
10. Type L, 10 mm clear tempered with sandblast surface, clear lettering, used for Signage at Lobby.

1.3.3 Description

Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work. Refer to curtain wall manufacturer's recommendations, structural documents and ASCE 7 for determining system requirements. Glazed panels shall comply with the safety standards, as indicated in accordance with ANSI Z97.1. Glazed panels shall comply with indicated wind/snow loading in accordance with ASTM E 1300.

1. Exterior fenestration is composed of curtain wall glazing assemblies, provided by a single manufacturer.
2. The clerestory has from inside to out an insulated unit of 7 mm safety laminated glass. The airspace will be 12 mm; the 6 mm exterior pane is tempered and tinted to darker green tint to match Dark Green.
3. The front curtain wall is gradated from dark (bottom) to clear (top). The bottom pane is "AZURLITE, OPACIFIED SPANDREL GLASS;"

the next is to match "AZURLITE," next to match PPG "SOLAR GREEN;" the top being clear. The assembly consists of insulating glass, similar to the assembly noted for the clerestory.

4. All exterior door glass shall be clear 7 mm safety laminated tempered glass, with 0.060 clear PVB interlayer.
5. All single aluminum glazed units shall be insulating glass; "DARK GREEN" outer pane; clear safety laminated glass inner pane with 0.060 clear PVB interlayer.
6. Glazed exterior doors at the evidence processing shall be wired clear annealed glass to meet criteria for a C-label 45-minute door.
7. All interior doors and glazed units shall be a minimum of 6 mm tempered.
8. All interior HM framed windows shall be 6 mm clear-annealed unless otherwise noted.
9. Display cases shall be 12 mm clear tempered glass with flat polished edges and silicone joints to create clear, clean precise corners. Submit for approval - calculations on glass thickness.
10. Artistic glass used with the motto in the lobby shall be custom designed by an approved artist and shall be etched/frosted white. Full shop drawings shall be submitted for approval.

1.4 DELIVERY, STORAGE AND HANDLING

Glazing compounds shall be delivered to the site in the manufacturer's unopened containers. Glass shall be stored indoors in a safe, well ventilated dry location in accordance with manufacturer's instructions, and shall not be unpacked until needed for installation. Glass shall not be stored on site over 1 month.

1.5 PROJECT/SITE CONDITIONS

Glazing work shall not be started until outdoor temperature is above 5 degrees C and rising, unless procedures recommended by glass manufacturer and approved by Contracting Officer are made to warm the glass and rabbet surfaces. Ventilation shall be provided to prevent condensation of moisture on glazing work during installation. Glazing work shall not be performed during damp or raining weather.

1.6 WARRANTY

1.6.1 Insulating Glass

Manufacturer shall warrant the insulating glass to be free of fogging or film formation on the internal glass surfaces caused by failure of the hermetic seal for a period of 10 years from Date of Substantial Completion. Warranty shall be signed by manufacturer.

1.6.2 Monolithic Opacified Spandrel

Manufacturer shall warrant the ceramic frit film on the spandrel to be free of peeling for a period of five years after Date of Substantial Completion. Warranty shall be signed by manufacturer.

PART 2 PRODUCTS (GENERAL)

2.1 FLAT GLASS

2.1.1 Annealed Glass

Annealed glass shall be Type I transparent flat type, Class 1 - clear, Quality q3 - glazing select, 6mm minimum thick conforming to ASTM C1036, Flat Glass.

2.1.2 Tinted (Light-Reducing) Glass

Tinted (light-reducing) glass shall be Type I transparent flat type, Class 3-tinted, Quality q3 - glazing select, conforming to ASTM C 1036. Color shall be as indicated in glazing schedule.

2.2 ROLLED GLASS

2.2.1 Wired Glass

Wired glass shall be Type II flat type, Quality 8 - glazing, Form 1 - wired and polished both sides conforming to Laminated Standard (UL 9). Wire mesh shall be polished stainless steel Mesh 2 - square. Wired glass for fire-rated windows shall bear an identifying UL label or the label of a nationally recognized testing agency, and shall be rated for 45-minutes when tested in accordance with NFPA 257. Wired glass for fire-rated doors shall be tested as part of a door assembly in accordance with NFPA 252. Color shall be clear.

2.3 INSULATING GLASS

Insulating glass shall be Class A preassembled units of dual-seal construction consisting of lites of glass separated by an aluminum spacer and dehydrated space conforming to ASTM E 773 and ASTM E 774. Spacer shall be roll-formed, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

2.4 HEAT-TREATED GLASS

Heat-treated glass shall conform to the following requirements.

2.4.1 Tempered Glass

Tempered glass shall be kind FT fully tempered transparent flat type, Class 2-tinted, Condition A uncoated surface, Quality q3 - glazing select,

27-percent light transmittance, conforming to 16 CFR 1201 and ANSI 297.1.

2.5 LAMINATED GLAZINGS

2.5.1 Laminated Glass

Laminated glass shall consist of two layers of float glass, laminated with plastic interlayer conforming to ASTM C1172. Glass shall be bonded together with 1.52 mm thick PVB (.060) interlayer under pressure, or alternatives such as resin laminates, conforming to requirements of 16 CFR 1201 and ASTM C 1172. Color shall be clear.

2.6 SPANDREL GLASS

2.6.1 Ceramic-Opacified Spandrel Glass

Ceramic-opacified spandrel glass shall be kind HS heat-strengthened or tempered, as required, transparent flat type, Condition B, coated with a colored ceramic material on No. 2 surface, Quality q3 - glazing select, conforming to ASTM C 1048.

2.7 FIRE/SAFETY RATED GLASS

Fire/safety rated glass shall be laminated Type I transparent flat type, Class 1-clear. Glass shall have a 45-minute rating when tested in accordance with ASTM E 119. Glass shall be permanently labeled with appropriate markings.

2.8 MIRRORS

2.8.1 Glass Mirrors

Glass for mirrors shall be Type I transparent flat type, Class 1-clear, Glazing Quality q2 6 mm thick conforming to ASTM C 1036. Glass color shall be clear. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 6 mm thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint, and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.8.2 Mirror Accessories

2.8.2.1 Mastic

Mastic for setting mirrors shall be a polymer type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion. Mastic shall be compatible with mirror backing paint, and shall be approved by mirror manufacturer.

2.8.2.2 Mirror Frames

Mirrors shall be provided with mirror frames (J-mold channels) fabricated of one-piece roll-formed Type 304 stainless steel with No. 4 brushed satin finish and concealed fasteners which will keep mirrors snug to wall. Frames shall be 32 x 6 x 6 mm continuous at top and bottom of mirrors. Concealed fasteners of type to suit wall construction material shall be provided with mirror frames.

2.8.2.3 Mirror Clips

Concealed fasteners of type to suit wall construction material shall be provided with clips.

2.9 GLAZING ACCESSORIES

2.9.1 Preformed Tape

Preformed tape shall be elastomeric rubber extruded into a ribbon of a width and thickness suitable for specific application. Tape shall be of type which will remain resilient, have excellent adhesion, and be chemically compatible to glass, metal, or wood.

2.9.2 Sealant

Sealant shall be elastomeric conforming to ASTM C 920, Type S or M, Grade NS, Class 12.5, Use G, of type chemically compatible with setting blocks, preformed sealing tape and sealants used in manufacturing insulating glass. Color of sealant shall be clear.

2.9.3 Glazing Gaskets

Glazing gaskets shall be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Glazing gasket profiles shall be as indicated on drawings.

2.9.3.1 Fixed Glazing Gaskets

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM C 509, Type 2, Option 1. In curtain wall, refer to manufacturer's recommended glazing method to meet system requirements.

2.9.3.2 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing shall be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight. Curtain wall shall have 1" bite and comply with testing specified in this section.

2.9.4 Setting and Edge Blocking

Neoprene setting blocks shall be dense extruded type conforming to ASTM D 395, Method B, Shore A durometer between 70 and 90. Edge blocking shall be Shore A durometer of 50 (+ or - 5). Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer. Length shall be 25 mm for each square meter of glazing or a minimum of 100 mm x width of glazing rabbet space minus 1.5 mm x height to suit glazing method and pane weight and area. Follow ASTM C 669 and ASTM C 864 for reference.

2.10 Spacer Shims

ASTM C864 Option I, Neoprene, 50 to 60 Shore A durometer hardness, minimum 75 mm long x one-half the height of the glazing stop x thickness to suit application, self-adhesive on one face.

PART 3 EXECUTION

3.1 PREPARATION

Openings and framing systems scheduled to receive glass shall be examined for compliance with approved shop drawings, GANA Glazing Manual and glass manufacturer's recommendations including size, squareness, offsets at corners, presence and function of weep system, face and edge clearance requirements and effective sealing between joints of glass-framing members. Detrimental materials shall be removed from glazing rabbet and glass surfaces and wiped dry with solvent. Glazing surfaces shall be dry and free of frost.

3.2 INSTALLATION

Glass and glazing work shall be performed in accordance with approved shop drawings, GANA Glazing Manual, glass manufacturer's instructions and warranty requirements. Glass shall be installed with factory labels intact and removed only when instructed. Wired glass and fire/safety rated glass shall be installed in accordance with NFPA 80. Edges and corners shall not be ground, nipped or cut after leaving factory. Springing, forcing or twisting of units during installation will not be permitted.

3.3 CLEANING

Upon completion of project, outside surfaces of glass shall be washed clean and the inside surfaces of glass shall be washed and polished in accordance with glass manufacturer's recommendations.

3.4 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the

reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

-- End of Section --

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SECTION 08900

GLAZED CURTAIN WALL

09/99

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SECTION 08900

GLAZED CURTAIN WALL
09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. All the latest versions of the referenced publications shall be used.

THE ALUMINUM ASSOCIATION, INCORPORATED (AA)

AA 1 Aluminum Standards and Data

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA MCWM-1 Metal Curtain Wall Manual

AAMA CW-10 Care and Handling of Architectural Aluminum from Shop to Site

AAMA 610.1 Cleaning and Maintenance of Painted Aluminum Extrusions and Curtain Wall Panels

AAMA 800 Sealants

AAMA 2605 Specification for High-Performance Organic Coatings on Architectural Extrusions and Panels

AMERICAN SOCIETY OF CIVIL ENGINEERS

ASCE 7 Minimum Design Loads for Buildings and Other Structures

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 221M Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

ASTM C 236 Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box

ASTM C 864 Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers

ASTM C 920	Elastomeric Joint Sealants
ASTM C 1036	Flat Glass
ASTM C 1048	Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
ASTM E 34	Chemical Analysis of Aluminum and Aluminum-Base Alloys
ASTM E 283	Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 330	Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
ASTM E 331	Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

CODE OF FEDERAL REGULATIONS (CFR)

16 CFR 1201	Architectural Glazing Materials
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NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MFM	Metal Finishes Manual
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1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

Glazed curtain wall system; G A/E
Aluminum Entrance Doors; G A/E

Submit for curtain wall system, accessories, and mock-up. Tentative approval of drawings shall be received before fabrication of mock-up. Final approval of drawings will be deferred pending approval of mock-up and accessories. Drawings shall indicate in detail all system parts including elevations, full-size sections, framing, jointing, panels, types and thickness of metal, flashing and coping details, field connections, weep and drainage system, finishes, sealing methods, glazing, glass sizes and details, insulation materials, and erection details.

SD-03 Product Data

Glazed curtain wall system; G A/E

Aluminum Entrance Doors; G A/E

Include descriptive literature, detailed specifications, and available performance test data.

SD-05 Design Data

Calculations

SD-07 Certificates

Test Reports

SD-08 Manufacturer's Instructions

Glazed curtain wall system

Aluminum Entrance Doors

Insulating glass

1.3 REQUIREMENT FOR SUBMITTALS

1.3.1 Preconstruction Conference

Hold with manufacturer and curtain wall/window/glazing installers.

1.3.2 Shop Drawings

Show fabrication and installation of glazed aluminum curtain wall system including plans, elevations, sections, details of components, and attachments to other units of work. For installed products indicated to comply with certain design loadings, include structural analysis data signed by the qualified professional engineer responsible for their preparation.

1.3.3 Product Data

Provide Product Data for each product specified, including details of construction relative to materials, dimensions of individual components, profiles and finishes.

1.3.4 Samples

Provide samples for verification of each type of exposed finish required in manufacturer's standard sizes. Where samples of the "approved" white involve color variations, provide sample showing the variations expected.

Provide a cutaway sample of each vertical to horizontal intersection of the system, made from 300 mm lengths of full size components showing details of the joinery, subframes, sills, anchorage, expansion provisions, glazing, flashing and drainage.

1.4 SYSTEM DESCRIPTION

- a. Provide glazed aluminum curtain wall system that has the following capabilities based on testing manufacturer's standard units in assemblies similar to those indicated for this project.
 - (1). Withstands loads and thermal and structural movement requirements indicated without failure. Failure includes air infiltration, water penetration exceeding specified limits, framing members transferring stresses including those caused by thermal and structural movements, to glazing units.
- b. Glazing is physically and thermally isolated from framing members.
- c. System is reglazable from the exterior (vision and spandrel).
- d. Wind Loads: Provide glazed aluminum curtain wall system, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or ASCE 7, Section 6.4.2, "Analytical Procedure", whichever are more stringent. Deflection of framing members in a direction normal to wall plane is limited to 1/75 of clear span or 19 mm whichever is smaller, unless otherwise indicated. Deflection of framing members in a direction normal to wall plane is limited to 1/360 of clear span, 19 mm maximum, where plaster or gypsum board surfaces are subject to bending.
- e. Seismic Loads: Provide glazed aluminum curtain wall system, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of authorities having jurisdiction or ASCE 7, Section 9, "Earthquake Loads", whichever are more stringent.
- f. Dead Loads: Provide glazed aluminum curtain wall system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.
- g. Live Loads: Provide glazed aluminum curtain wall system, including anchorage, that accommodates supporting structure's deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.
- h. Air Infiltration: Provide glazed aluminum curtain wall system with permanent resistance to air leakage through system of not more than 0.3 L/s/sq.m of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 299 Pa.
- i. Water Penetration: Provide glazed aluminum curtain wall system that does not evidence water leakage when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward acting wind-load design pressure as defined by ASCE 7, but not less than 479 Pa.
- j. Thermal Movements: Provide glazed aluminum curtain wall system, including anchorage, that accommodates thermal movements of system

and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, noise or vibration, and other detrimental effects. Temperature change (range) is 67 degrees C, ambient; 100 degrees C, material surfaces.

- k. Structural Movement: Provide glazed aluminum curtain wall system that accommodates structural movements including, but not limited to, sway, twist, column shortening, long-term creep, and deflection.
- l. Condensation Resistance: Provide glazed aluminum curtain wall system with condensation-resistance factor (CRF) of not less than 55 when tested according to AAMA 1503.1.
- m. Average Thermal Conductance: Provide glazed aluminum curtain wall system with an average U-value of not more than 3.75 W/sq.m x K when tested according to AAMA 1503.1. Provide thermal breaks at all locations.
- n. Sound Transmission: Provide glazed aluminum curtain wall system with average sound transmission loss through system of not less than 34 dB when tested according to ASTM E 90.
- o. Dimensional Tolerances: Provide glazed aluminum curtain wall system, including anchorage, that accommodates dimensional tolerances of building frame and other adjacent construction.

1.5 QUALITY ASSURANCE

1.5.1 Testing Requirements

See submittal requirements above for required testing.

The components listed below shall have been tested in accordance with the requirements below, and shall meet performance requirements specified.

- a. Joint and Glazing Sealants: Perform tests as required by applicable publications referenced.
- b. Preformed Compression Gaskets and Seals: ASTM C 864.
- c. Preformed Lock-strip Gaskets: ASTM C 542, modified as follows: Heat age specimens seven days at 70 degrees C, in zipped or locked position under full design compression. Unzip, cool for one hour, re-zip, and test lip seal pressure, which shall be minimum 0.045 kilograms per linear millimeter on any extruded or corner specimen.
- d. Spandrel Glass: Fallout resistance test, ASTM C 1048.

1.5.2 Mockup

1.5.2.1 Construction

Construct at job site full size typical wall unit which incorporates horizontal and vertical joints, framing, window units, panels, glazing, and other accessories as detailed and specified. Mock-up wall unit size and design shall be as indicated.

1.5.2.2 Performance Test

Conduct after approval of visual aspects has been obtained. Finished work shall match approved mock-up.

1.5.2.3 Approved Mock-Up

After completion and approval of test results install, where directed, for reference during construction. Approved mock-up shall remain property of the Contractor.

1.5.3 Factory Tests

Perform the following tests except that where a curtain wall system or component of similar type, size, and design as specified for this project has been previously tested, under the conditions specified.

1.5.3.1 Deflection and Structural Tests

The curtain wall shall meet all structural requirements in accordance with design load defined under the specified sections and in the structural drawings.

No curtain wall framing member shall deflect, in a direction normal to the plane of the wall, more than $1/175$ of its clear span or 20 mm, whichever is less, when tested in accordance with ASTM E 330, except that when a plastered surface will be affected the deflection shall not exceed $1/360$ of the span. No framing member shall have a permanent deformation in excess of 0.2 percent of its clear span when tested in accordance with ASTM E 330 for a minimum test period of 10 seconds at 1.5 times the design wind pressures specified.

1.5.3.2 Water Penetration Test

No water penetration shall occur when the wall is tested in accordance with ASTM E 331 at a differential static test pressure of 20 percent of the inward acting design wind pressure as specified, but not less than 0.19 kPa. Make provision in the wall construction for adequate drainage to the outside of water leakage or condensation that occurs within the outer face of the wall. Leave drainage and weep openings in members and wall open during test.

1.5.3.3 Air Infiltration Test

Air infiltration through the wall, when tested in accordance with ASTM E 283, shall not exceed 0.005 cms per sq. m of fixed wall area, plus the permissible allowance specified for operable windows within the test area.

1.5.3.4 Thermal Conductance Tests

The thermal transmittance of opaque panels shall not exceed specified U-value, when tested in accordance with ASTM C 236. The average calculated thermal transmittance of the complete wall assembly including panels, windows, and all other components shall not exceed a U-value of .57. Determine U-values of components in accordance with ASTM C 236.

1.6 GLAZED CURTAIN WALL SYSTEM REQUIREMENTS

Provide system complete with framing, mullions, trim, panels, windows, doors, glass, glazing, sealants, insulation, fasteners, anchors, accessories, concealed auxiliary members, and attachment devices for securing the wall to the structure as specified or indicated.

1.6.1 Source

Curtain wall system components shall be furnished by one manufacturer or fabricator; however, all components need not be products of the same manufacturer.

1.6.2 Design

Stick system with mullions, horizontal rails, with nonintegral spandrel panels. Fully coordinate system accessories directly incorporated, and adjacent to contiguous related work and insure materials compatibility, deflection limitations, thermal movements, and clearances and tolerances as indicated or specified.

1.6.3 Thermal Movement

Fabricate, assemble, and erect system with adequate allowances for expansion and contraction of components and fastenings to prevent buckling damage, joint seal failure, glass breakage, undue stress on fastenings or other detrimental effects.

1.6.4 Tolerances

Design and erect wall system to accommodate tolerances in building frame and other contiguous work as indicated or specified. Provide with the following tolerances:

- a. Maximum variation from plane or location shown on approved shop drawings: one millimeter per 12 meters of length up to not more than 13 mm in any total length.
- b. Maximum offset from true alignment between two identical members abutting end to end in line: 2 mm.

1.6.5 Structural Requirements

No member shall deflect in a direction parallel to the plane of the wall, when carrying its full design load, more than an amount which will reduce the edge cover or glass bite below 75 percent of the design dimension. No

member after deflection under full design load, shall have a clearance between itself and the top of the panel, glass, sash, or other part immediately below it less than 3 mm; the clearance between the member and an operable window or door shall be minimum 2 mm.

1.7 DELIVERY AND STORAGE

Inspect materials delivered to the site for damage; unload and store with a minimum of handling in accordance with recommendations contained in AAMA CW-10. Storage spaces shall be dry locations with adequate ventilation, free from heavy dust, not subject to combustion products or sources of water, and shall permit easy access for inspection and handling. Deliver calking and sealing compounds to the job site in sealed containers labeled to show the designated name, formula or specifications number; lot number; color; date of manufacturer; shelf life; and curing time when applicable.

1.7.1 Protective Covering

Prior to shipment from the factory, place knocked-down lineal members in cardboard containers and cover finished surfaces of aluminum with protective covering of adhesive paper, waterproof tape, or strippable plastic. Covering shall not chip, peel, or flake due to temperature or weather, shall protect against discoloration and surface damage from transportation, and storage, and shall be resistant to alkaline mortar and plaster. Do not cover aluminum surfaces that will be in contact with sealants after installation.

1.7.2 Identification

Prior to delivery, mark wall components to correspond with shop and erection drawings placement location and erection.

1.8 WARRANTY

Provide a five year warranty on the materials and a two year warranty on the installation of the complete system including glazing in accordance with Section 08810. Provide a 20 year warranty on the finish.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aluminum

Shall be free from defects impairing strength or durability of surface finish. Standard alloys shall conform to standards and designations of AA 1. Special alloys, not covered by the following ASTM specifications, shall conform to standards and designations recommended by the manufacturer for the purpose intended.

2.1.1.1 Wrought Aluminum Alloys

Shall be those which include aluminum alloying elements not exceeding the following maximum limits when tested and additional in accordance with ASTM

E 34. These limits apply to both bare products and the core of clad products. The cladding of clad products shall be within the same limits except that the maximum zinc limit may be 2.5 percent in order to assure that the cladding is anodic to the core. The alloy shall be 6063T5. Special wrought alloys with a silicon content not more than 7.0 percent will be acceptable for limited structural uses where special appearance is required:

<u>ALLOY</u>	<u>PERCENT</u>
Silicon	1.5
Magnesium, Manganese, and Chromium combined	6.0
Iron	1.0
Copper	0.4
Zinc	1.0

Within the chemical composition limits set forth above, wrought aluminum alloys shall conform to the following:

- a. Extruded bars, rods, shapes and tubes: ASTM B 221M.
- b. Sheet and Plate: ASTM B 209M.

2.1.1.2 Cast Aluminum Alloys

Provide those in which the alloying elements are silicon, magnesium, manganese, or a combination of these. Other elements shall not exceed the following limits:

<u>ELEMENT</u>	<u>PERCENT</u>
Iron	1.2
Copper	0.4
Nickel	0.4
Titanium	0.2
Others (total)	0.5

Within the chemical composition limits set forth above, cast aluminum alloys shall conform to the following:

- a. Sand castings: ASTM B 26/B 26M.
- b. Die casting: ASTM B 85.
- c. Permanent mold castings: ASTM B 108.

2.1.1.3 Fabrication

All aluminum vertical and horizontal main frame extrusions shall have a minimum wall thickness of 3 mm. Frame components shall be mechanically fastened by means of extruded aluminum shear blocks attached to vertical mullions. Curtain wall system shall be able to accommodate separate interior and exterior finishes and colors. Outside glazed curtain walls system shall be dry glazed with an exterior aluminum pressure plate and snap cover with interior and exterior dense EPDM preset gasket.

2.1.1.4 Finish

Kynar finish on aluminum surfaces shall match in appearance or fall within the two extremes of color range of the approved samples. The following designation of finishes refer to standard finishes as defined in the NAAMM MFM. Finish designation is Kynar 500, AA-M12-C42-R1, as defined in AAMA 2605, Mil thickness shall be in accordance with ASTM B 137. Color shall be Bone White.

2.1.1.5 Strength

Aluminum extrusions for framing members used in curtain walls shall have a minimum ultimate tensile strength of 152 MPa and a minimum yield strength of 110 MPa. Provide strength of a minimum of T6.

2.1.2 Metal Fasteners

Provide fasteners as specified in paragraph entitled "Fastener Metals for Joining Various Metal Combinations" in "Part 2 - Products" of the AAMA MCWM-1. Metals used for fasteners shall be chemically and galvanically compatible with contiguous materials.

2.1.3 Joint Sealants and Accessories

Provide manufacturer's standard colors as closely matching the adjacent surfaces as possible.

2.1.3.1 Elastomeric, Single or Multiple Component

ASTM C 920, Type S, single component. Use Grade NS, nonsag type in joints on vertical surfaces and use Grade P, self-leveling or flow type, in joints on horizontal surfaces.

2.1.3.2 Single Component Silicone Rubber Base

ASTM C 920, Type S, Grade NS (Silicone).

2.1.3.3 Solvents and Primers

Provide material which is quick drying, colorless, nonstaining, compatible with compound used, as recommended by sealant manufacturer. Where primer is specified or recommended by sealant manufacturer, tests related to that material shall include primer.

2.1.3.4 Backing Material

Provide material which is nonstaining, nonabsorbent, and compatible with sealing compound. Closed-cell sponge of rubber; closed cell neoprene or butyl rod; or polychloroprene tubes.

2.1.4 Glass and Glazing

Materials are specified under Section 08810, "Glass and Glazing". Conform to ASTM C 1036, except ASTM C 1048 for spandrel glass. All glazing material must be certified as meeting 16 CFR 1201.

2.1.4.1 Glass Sizes and Clearances

Sizes indicated are nominal. Verify actual sizes required by measuring frames. Coordinate dimensions for glass and glass holding members to meet applicable minimum clearances as recommended by glass manufacturer. Do not nip to remove flares or to reduce oversized dimensions.

2.1.4.2 Glass Types

Glass as specified under Section 08810 shall be used. The curtain wall installer shall provide and install the glass, curtain wall and aluminum doors.

2.2 Aluminum Entrance Doors

Manufacturer's standard glazed doors, for manual swing operation.

2.2.1 Door Construction

44.5 mm overall thickness, with minimum 3.2 mm thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.

2.2.2 Door Design

Wide stile; 127-mm nominal width. Accessible doors shall be smooth surfaced for width of door in area within 255 mm above floor or ground plane.

2.2.3 Glazing Stops and Gaskets

Beveled, snap-on, extruded-aluminum stops and preformed gaskets. Provide nonremovable glazing stops on outside of door.

PART 3 EXECUTION

3.1 FABRICATION

The curtain wall components shall be of the materials and thickness indicated or specified. The details indicated are representative of the

required design and profiles. Acceptable designs may differ from that shown if the proposed system components conform to the limiting dimensions indicated and the requirements specified herein. Unless specifically indicated or specified otherwise, the methods of fabrication and assembly shall be at the discretion of the curtain wall manufacturer. Perform fitting and assembling of components in the shop to the maximum extent practicable. Anchorage devices shall permit adjustment in three directions. Exposed fastenings used on finished surfaces shall be truss head, flat head, or oval head screws or bolts.

3.1.1 Joints

Provide welded or mechanical fasteners as indicated or specified. Match joints in exposed work to produce continuity of line and design. Bed-joints or rabbets receiving calking or sealing material shall be minimum 20 mm deep and 10 mm wide at mid ambient temperature range.

3.1.2 Shop Welding

Conform to AWS A5.10. Use methods and electrodes recommended by manufacturers of base metal alloys. Welding rods shall be of an alloy that matches the color of the metal being welded. Ground and finish weld beads on exposed metal surfaces to minimize mismatch and to blend with finish on adjacent parent metal. If flux is used in welding aluminum, completely remove it immediately upon completion of welding operations. Do not use exposed welds on aluminum surfaces.

3.1.3 Ventilation and Drainage

Provide internal ventilation drainage system of weeps or based on principles of pressure equalization to ventilate the wall internally and to discharge condensation and water leakage to exterior as inconspicuously as possible. Flashings and other materials used internally shall be nonstaining, noncorrosive, and nonbleeding.

3.1.4 Protection and Treatment of Metals

3.1.4.1 General

Remove from metal surfaces lubricants used in fabrication and clean off other extraneous material before leaving the shop.

3.1.4.2 Galvanic Action

Provide protection against galvanic action wherever dissimilar metals are in contact, except in the case of aluminum in permanent contact with galvanized steel, zinc, stainless steel, or relatively small areas of white bronze. Paint contact surfaces with one coat bituminous paint or apply appropriate calking material or nonabsorptive, noncorrosive, and nonstaining tape or gasket between contact surfaces.

3.1.4.3 Protection for Aluminum

Protect aluminum which is placed in contact with, built into, or which will

receive drainage from masonry, lime mortar, concrete, or plaster with one coat of alkali-resistant bituminous paint. Where aluminum is contacted by absorptive materials subject to repeated wetting or treated with preservative noncompatible with aluminum, apply two coats of aluminum paint, to such materials and seal joints with approved calking compound.

3.2 INSTALLATION

Installation and erection of glazed wall system and all components shall be performed under direct supervision of and in accordance with approved recommendations and instructions of wall system manufacturer or fabricator. Installer shall be approved by manufacturer.

3.2.1 Bench Marks and Reference Points

Establish and permanently mark bench marks for elevations and building line offsets for alignment at convenient points on each floor level. Should any error or discrepancy be discovered in location of the marks, stop erection work in that area until discrepancies have been corrected.

3.2.2 Verifying Conditions and Adjacent Surfaces

After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other permissible dimensional tolerances in the building frame.

3.2.3 Sealing

Seal exterior metal to metal joints between members of frames and mullions. Remove excess sealant.

3.2.4 Joint Sealants

3.2.4.1 Surface Preparation

Surfaces to be primed and sealed shall be clean, dry to the touch, free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter. Enclose joints on three sides. Clean out grooves to proper depth. Joint dimensions shall conform to approved detail drawings with a tolerance of plus 3 mm. Do not apply compound unless ambient temperature is between 4 and 32 degrees C. Clean out loose particles and mortar just before sealing. Remove protective coatings or coverings from surfaces in contact with sealants before applying sealants or tapes. Solvents used to remove coatings shall be of type that leave no residue on metals.

3.2.4.2 Applications

Match approved sample. Force compound into grooves with sufficient pressure to fill grooves solidly. Sealing compound shall be uniformly smooth and free of wrinkles and, unless indicated otherwise, shall be tooled and left sufficiently convex to result in a flush joint when dry. Do not trim edges of sealing material after joints are tooled. Mix only

amount of multi-component sealant which can be installed within four hours, but at no time shall this amount exceed 19 liters.

3.2.4.3 Primer

Apply to masonry, concrete, wood, and other surfaces as recommended by sealant manufacturer. Do not apply primer to surfaces which will be exposed after calking is completed.

3.2.4.4 Backing

Tightly pack in bottom of joints which are over 13 mm in depth with specified backing material to depth indicated or specified. Roll backing material of hose or rod stock into joints to prevent lengthwise stretching.

3.2.4.5 Bond Prevention

Install bond preventive material at back or bottom of joint cavities in which no backstop material is required, covering full width and length of joint cavities.

3.2.4.6 Protection and Cleaning

Remove compound smears from surfaces of materials adjacent to sealed joints as the work progresses. Use masking tape on each side of joint where texture of adjacent material will be difficult to clean. Remove masking tape immediately after filling joint. Scrape off fresh compound from adjacent surfaces immediately and rub clean with approved solvent. Upon completion of calking and sealing, remove remaining smears, stains, and other soiling, and leave the work in clean neat condition.

3.2.5 Glass

Install in accordance with manufacturer's recommendations and as specified herein.

3.2.5.1 Preparation of Glass and Rabbets

Clean sealing surfaces at perimeter of glass and sealing surfaces of rabbets and stop beads before applying glazing compound, sealing compound, glazing tape, or gaskets. Use only approved solvents and cleaning agents recommended by compound or gasket manufacturer.

3.2.5.2 Positioning Glass

Maintain specified edge clearances and glass bite at perimeter. Maintain position of glass in rabbet and provide required sealant thickness on both sides of glass. For glass dimensions larger than 1270 united millimeters, provide setting blocks at sill and spacer shims on all four sides; locate setting blocks by the dimension as recommended by manufacturer in from each jamb edge of glass.

3.2.5.3 Void Space

Heat absorbing, insulating, spandrel, and tempered glass, and glass of other types that exceed 2540 united millimeters in size: Provide void space at head and jamb to allow glass to expand or move without exuding the sealant.

3.2.5.4 Insulating Glass

Provide adequate means to weep incidental water and condensation away from the sealed edges of insulated glass units and out of the wall system. The weeping of lock-strip gaskets should be in accordance with the recommendation of the glass manufacturer.

3.2.5.5 Insulating Glass With Edge Bands

Insulating glass with flared metal edge bands set in lock-strip type gaskets: Follow glass manufacturer's recommendations and add supplementary wet seal as required; when used with glazing tape, use tapered tape.

3.2.6 Aluminum Entrance Doors

Install to produce smooth operation and tight fit at contact points and at weather stripping and weathertight closure. Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.3 FIELD TESTS

Conduct field check test for water leakage on designated wall areas after erection. Conduct test on two wall areas, two bays wide by two stories high where directed. Conduct test and take necessary remedial action as described in AAMA 501.

3.4 CLEANING AND PROTECTION

3.4.1 Glass

Upon completion of wall system installation, thoroughly wash glass surfaces on both sides and remove labels, paint spots, putty, compounds, and other defacements. Replace cracked, broken, and defective glass with new glass at no additional cost to the Government.

3.4.2 Aluminum Surfaces

Protection methods, cleaning, and maintenance shall be in accordance with AAMA 610.1.

3.4.3 Other Metal Surfaces

After installation, protect windows, panels, and other exposed surfaces from disfiguration, contamination, contact with harmful materials, and from other construction hazards that will interfere with their operation, or damage their appearance or finish. Protection methods shall be in accordance with recommendations of product manufacturers or of the respective trade association. Remove paper or tape factory applied

protection immediately after installation. Clean surfaces of mortar, plaster, paint, smears of sealants, and other foreign matter to present neat appearance and prevent fouling of operation. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or the respective trade association.

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SECTION 09260

GYPSUM BOARD ASSEMBLIES

04/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. The latest versions of the referenced publications shall be used.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A136.1	American National Standard for Organic Adhesives for Installation of Ceramic Tile
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 36	Gypsum Wallboard
ASTM C 442	Gypsum Backing Board and Core Board.
ASTM C 475	Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C 630	Water-Resistant Gypsum Backing Board
ASTM C 645	Nonstructural Steel Framing Members
ASTM C 665	Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 754	Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
ASTM C 840	Application and Finishing of Gypsum Board
ASTM C 919	Standard Practice for Use of Sealants in Acoustical Applications
ASTM C 1002	Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases
ASTM E 90	Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
ASTM E 119	Fire Tests of Building Construction and Materials

GYPSUM ASSOCIATION (GA)

GA 201	Gypsum Construction Handbook
GA 214	Recommended Specifications for the Application and Finishing of Gypsum Board
GA 219	Recommendations for Installation of Steel Fire Door Frames in Steel Stud-Gypsum Board Fire-Rated Partitions
GA 600	Fire Resistance Design Manual

UNDERWRITERS LABORATORIES, INC. (UL)

FIR RESIST DIR	Fire Resistance Directory
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1.2 SYSTEM DESCRIPTION

1.2.1 Assembly Performance Requirements

1.2.1.1 Sound Transmission Characteristics

For gypsum board assemblies with STC ratings, provide materials and construction identical to those of assemblies whose STC ratings were determined according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1.2.1.2 Fire Resistance

Provide gypsum board assemblies with fire-resistance ratings indicated.

1.2.2 Design Requirements for Metal Framing

Select gage of framing members and establish spacing to comply with requirements of ASTM C 754 and the following. Deflection not greater than L/240 when loaded with 24 kg/m². Spacing between members not greater than 600 mm on center.

Establish bracing size and spacing for metal framed partitions based upon loading requirements.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

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SD-02 Shop Drawings

Wall Assemblies; G ~~REA/E~~

Submit shop drawings for special assemblies designated on the drawings, including details sufficient to show compliance with

design intent and performance requirements.

SD-03 Product Data

Steel Framing; G ~~REA/E~~
Panel Products; G ~~REA/E~~

Submit manufacturer's product data for systems required, including installation instructions and data sufficient to show compliance with requirements.

SD-06 Test Reports

From a qualified independent testing and inspecting agency substantiating each gypsum board assembly's required fire-resistance rating.

SD-05 Design Data

Submit data substantiating gage and spacing of metal framing members to comply with specified loading requirements.

Submit data substantiating bracing requirements.

Submittal of manufacturer's standard published load tables, marked to show products selected to comply with design requirements and project conditions, will be acceptable. Where manufacturer's standard published load tables are not adequate to demonstrate compliance with design requirements and project conditions, submit design data bearing the seal of a professional engineer licensed to practice in the state in which the project is located.

1.4 QUALITY ASSURANCE

1.4.1 Steel Framing

Obtain steel framing members for gypsum board assemblies from a single manufacturer, unless otherwise indicated.

1.4.2 Panel Products

Obtain each type of gypsum board and other panel products from a single manufacturer.

1.4.3 Finishing Materials

Obtain finishing material from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

1.4.4 Fire-Test-Response Characteristics

Where fire-resistance-rated gypsum board assemblies are indicated, provide gypsum board assemblies that comply with the following requirements:

1. Fire-Resistance Ratings: As indicated by GA 600 or design designations in FIR RESIST DIR or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

2. Gypsum board assemblies indicated are identical to assemblies tested for fire resistance according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

3. Deflection and Firestop Track: Top runner provided in fire-resistance-rated assemblies indicated is labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.4.5 Mock-ups

Prior to finishing gypsum board assemblies, construct mock-ups of at least 9 sq. m in surface area to demonstrate aesthetic effects of finishes as well as qualities of materials and execution. Simulate finished lighting conditions for review of in-place unit of work.

1. Construct mock-ups for wall surfaces and ceiling surfaces indicated to receive nontextured paint finishes.

2. Locate mock-ups on-site in the location and of the size indicated or, if not indicated, as directed by the Contracting Officer. Notify Contracting Officer one week in advance of the dates and times when mock-ups will be constructed. Demonstrate the proposed range of aesthetic effects and workmanship. Obtain Contracting Officer's approval of mock-ups before start of final unit of work. Retain and maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work. Approved mock-ups in an undisturbed condition become part of the completed work.

1.5 QUALIFICATIONS

1.5.1 Applicator

Company specializing in performing the work of this section with minimum five (5) years documented experience approved by manufacturer.

1.6 REGULATORY REQUIREMENTS

a. Conform to applicable code for fire rated assemblies in conjunction with the following:

1. Fire Rated Partitions: Listed assembly by UL
2. Fire Rated Structural Column Framing: Listed assembly by UL
3. Fire Rated Structural Beam Framing: Listed assembly by UL

1.7 DELIVERY, STORAGE AND HANDLING

Deliver materials in original and unopened packages, containers, or bundles, with brand names and manufacturer's labels intact and legible. Store materials in dry location, fully protected from weather and direct exposure to sunlight. Stack gypsum board products flat and level, properly supported to prevent sagging or damage to ends and edges. Store corner bead and other metal and plastic accessories to prevent bending, sagging, distortion, or other mechanical damage.

1.8 PROJECT CONDITIONS

Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent. For nonadhesive attachment of gypsum board to framing, maintain not less than 4 degrees C. For adhesive attachment and finishing of gypsum board, maintain not less than 10 degrees C for 48 hours before application and continuously after until dry. Do not exceed 35 degrees C when using temporary heating sources. Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Acceptable manufacturers offering equivalent products.

- a. USG Corporation
- b. Unimast Incorporated
- c. National Gypsum Company

2.2 FRAMING MATERIALS

2.2.1 General

Select size and gage of framing members and establish spacing to comply with requirements of ASTM C 754 unless otherwise specifically indicated. Maximum deflection $L/240$ at 5lbf per square foot.

2.2.2 Studs and Tracks

Shall conform to ASTM C 645 with a protective coating. Nominal depths as indicated on the drawings.

2.2.3 Modified Deflection Track Detail

Manufacturer's standard top runner detailed to prevent cracking of gypsum board applied to interior partitions resulting from deflection of the structure above. Refer to Part 3 - EXECUTION.

2.2.4 Deflection and Firestop Track

Top runner designed to allow partition heads to expand and contract with movement of structure above while maintaining continuity of the assembly. Comply with requirements of ASTM C 645 except configuration, of thickness indicated for studs and width to accommodate depth of studs indicated with flanges offset at midpoint to accommodate gypsum board thickness.

2.2.5 Ceiling Channels

Comply with ASTM C 754, cold-rolled or hot-rolled steel, with rust-inhibitive finish.

2.2.6 Hanger Wire

Comply with ASTM A 641, soft, Class 1 galvanized. Ceiling hangers minimum 8 gage wire. Furring channel ties minimum 18 gage wire.

2.2.7 Furring Members

Comply with ASTM C 645, steel with protective coating. Hat-shaped except as otherwise indicated. Where indicated as "resilient" or "acoustical", or where required for STC ratings indicated, provide manufacturer's special type designed for attachment by one flange for reduced sound transmission. C-shaped studs in locations indicated. Manufacturer's standard galvanized Z-shaped furring members designed for screw attachment, minimum 0.0179 inch base metal thickness, in locations indicated.

2.2.8 Furring Fasteners/Connectors

Manufacturer's recommended system for specific application indicated, complying with ASTM C 754.

2.3 GYPSUM BOARD MATERIALS

2.3.1 Gypsum Wallboard

Shall conform to ASTM C 36, maximum lengths available. Fire-resistant type (type X or equivalent), where required for fire-resistance-rated assemblies. Foil-backed type, at locations indicated. Edges featured (rounded or beveled) and tapered. Thickness 15.8 mm all locations. 13 mm board not acceptable.

2.3.2 Moisture-Resistant Gypsum Backing Board

Shall conform to ASTM C 630, regular type, unless otherwise indicated. Type X where required for fire-resistance-rated assemblies and where indicated. Thickness 15.8 mm all locations. 13 mm board not acceptable.

2.3.3 Manufacturers

Provide products complying with requirements of the contract documents and made by one of the following.

- a. USG Corporation
- b. National Gypsum Corporation
- c. G-P Gypsum Corporation

2.4 TRIM AND ACCESSORIES

2.4.1 General

Except otherwise specifically indicated, provide trim and accessories by manufacturer of gypsum board materials, made of galvanized steel or zinc alloy and configured for concealment of joint compound. Include corner beads, edge trim, and other trim units necessary for project conditions. Provide accessories as required in order to achieve details indicated, whether or not specific accessories are shown on the drawings.

2.4.2 Semi-Exposed Edge Trim

At locations indicated, provide the following trim units. Manufacturer's standard "mud-in" type "L" or "U" shaped galvanized members for finishing with joint compound.

2.4.3 Control Joints

At locations indicated, provide manufacturer's standard one-piece control joints of zinc alloy.

2.5 JOINT TREATMENT

2.5.1 General

Provide products by manufacturer of gypsum boards. Comply with ASTM C 475 and with manufacturer's recommendations for specific project conditions.

2.5.2 Joint Tape

Provide open-weave fiberglass tape for joint treatment of water-resistant gypsum backing board. Elsewhere, provide manufacturer's standard paper type tape or fiberglass tape.

2.5.3 Joint Compound

General use vinyl-based ready-mixed type for interior use, and as follows. Taping compound specifically formulated for embedding tape and accessories and for prefilling. Topping compound specifically formulated for finishing drywall over taping compound. At joints and fasteners in water-resistant gypsum backing board intended for tile surfacing, provide setting-type compound specifically recommended by manufacturer of gypsum board. Joint tape and compound for use with high performance gypsum backing board, specified elsewhere.

2.6 MISCELLANEOUS MATERIALS

2.6.1 General

Provide miscellaneous materials as produced or recommended by manufacturer of gypsum products.

2.6.2 Sound Attenuation Blankets

Comply with ASTM C 665, Type I; unfaced semirigid mineral fiber mat; thickness as indicated on the drawings.

2.6.3 Glass Fiber Sound Attenuation Blankets

Comply with UL material requirements and as scheduled.

2.6.4 Screws

Comply with ASTM C 1002; self-drilling type; lengths as recommended by gypsum board manufacturer for project conditions.

2.6.5 Acoustical Sealants

Comply with ASTM C 919; nondrying, nonhardening, nonskinning type for concealed locations; non oxidizing, skinning type for exposed locations.

2.6.6 Sealing

At water-resistant gypsum backing board, provide Type I organic adhesive per ANSI A136.1.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

Verify that project conditions and substrates are appropriate to begin installation of work of this section. Coordinate installation of anchorage devices for suspended ceilings/soffits, verifying that spacing and rated strength are correct for anticipated load conditions.

3.2 FIRE-RATED ASSEMBLIES

At locations indicated on drawings, provide fire-rated assemblies tested in accordance with ASTM E 119 and acceptable to authorities for rating required. Provide assemblies as listed in FIR RESIST DIR and constructed in accordance with the contract documents.

3.3 INSTALLATION OF METAL FRAMING

3.3.1 General

Comply with provisions of ASTM C 754 except where exceeded by other requirements. Spacing shall comply with design requirements specified in Part 1 of this Section.

3.3.2 Suspended Ceilings and Soffits

Secure hangers to structure or to anchorage devices so that full strength of hanger can be achieved. Install ceiling channels at spacing indicated or required, but not greater than permitted by ASTM C 754. Secure furring members by means of screws, clips, or wire ties, as appropriate to substrate. Level ceiling system to a tolerance of 3 mm in 3600 mm, or to a higher tolerance if required by specific project conditions. Level soffits to a tolerance of 3 mm in 3600 mm, or to a higher tolerance if required by specific project conditions. Reinforce openings and interruptions in horizontal framing system with additional furring channels. Ensure that entire suspension system is laterally braced.

3.3.3 Steel Studs

Install tracks and studs in accordance with manufacturer's recommendations and as follows. Door openings, comply with GA 201; reinforce openings as required for size and weight of doors, but in no case less than two 25-gage side-by-side studs on each side of opening. At openings in fire-rated partitions, comply with requirements governing authorities for framing.

3.3.4 Partition Heights

Where not indicated otherwise, extend partitions from floor to underside of solid structure above. Where indicated, extend partitions to underside of suspended ceiling or to just above suspended ceiling, as indicated in the Partition Schedule. Brace partial height partitions in accordance with design requirement specified in Part 1 of this Section. Install blocking and bracing as recommended by manufacturer for adequate support of wall-mounted items installed as work of other sections.

3.3.5 Wall Furring

Install wall furring members in accordance with manufacturer's recommendations. Resilient furring members shall be installed by means of fasteners in single flange, in accordance with manufacturer's instructions.

On solid walls, install furring members vertically.

3.3.6 Modified Deflection Track Detail

At full-height interior partitions only and at non-fire rated partitions, construct deflection track detail allowing for 13 mm joint head in accordance with manufacturer's standard recommendations, by cutting vertical studs 13 mm short and not screw mounting to top rack. Gypsum Board is screwed to verticals at maximum 75 mm from top rack. At fire-rated partitions, provide UL required components or construct slip-joint head in accordance with UL-witnessed reports and manufacturer's recommendations.

3.4 NOISE, AIR AND DUST CONTROL

3.4.1 General

Every partition dividing two spaces is a noise-control partition. Seal noise control partitions in accordance with the requirements listed. Seal gypsum panels used on the interior face of exterior walls in the same manner.

3.4.2 Partition Perimeters

Seal perimeter of partition with acoustical sealant, complying with recommendations and details in GA 201 and ASTM C 919. Do not install sealant under metal runners. Install 6 mm bead of sealant to in-place runners including those used at partition intersections. Immediately place gypsum panel so as to compress bead, leaving 3 mm of perimeter relief between gypsum panel and adjacent construction. Install sealant between metal edge trim and adjacent construction. Install sealant beneath control joints. Install sealant at metal door frames just before inserting face panel. Carefully seal around penetrations such as electrical boxes, plumbing, cabinets, ducts, and other openings.

3.4.3 Sound Attenuation Blankets

At partitions indicated, install sound attenuation blankets after gypsum board has been installed on one side. Fill cavities completely, using recommendations and details indicated in GA 201.

3.5 INSTALLATION OF GYPSUM BOARD

3.5.1 General

Comply with ASTM C 840 and GA 216 except where exceeded by other requirements. Whenever possible, install gypsum board to minimize butt end joints. Apply ceiling boards prior to installation of wallboards. Arrange to minimize butt end joints near center of ceiling area. Install wallboards in a manner which will minimize butt end joints in center of wall area. Stagger vertical joints on opposite sides of walls. Butt all joints loosely, with maximum of 1.5 mm between boards. Size panels to provide perimeter relief and install over sealant as specified under noise control, above. Do not install panels unless and until sealant is properly installed. Place wrapped edges adjacent to one another, do not place cut edges or butt ends adjacent to wrapped edges. Support all edges at right angles of each board on framing or by solid substrate, except that long edges at right angles to framing members in non-fire-rated construction may be left unsupported. In double-layer ceiling work apply base layer with

long edges perpendicular to framing members, with face layer in opposite direction, and with all joints offset. In double-layer wall applications, apply base layer with long edges parallel to framing members, with face layer in opposite direction, and with all joints offset.

3.5.2 Control Joints

Form control joints by means of 6 mm space between adjacent gypsum boards, with each edge supported on separate framing member, ready to receive trim accessory, and located not more than 9 m apart on walls which are not intersected by other walls for 15 m or more; on ceilings with perimeter relief not more than 15 m apart in both directions; on ceilings without perimeter relief, not more than 9 m apart in both directions. Review location of control joints with Contracting Officer for "visual" approval prior to installation.

3.5.3 Isolation Joints

Where gypsum board construction intersects structural components, provide isolation by stopping board a minimum 1/4 inch from structural components, for finishing by means of exposed or semi-exposed trim.

3.5.4 Installation on Metal Framing and Furring

3.5.4.1 Single-Layer Application

Install gypsum board by means of screw attachment. On walls and partitions, plan installation so that leading edge or end of gypsum board is attached to open end of stud flange first.

3.5.4.2 Double-Layer Application

Install base layer by means of 25 mm screws, spaced at 600 mm on center. Install face layer by means of screws at least 9.5 mm longer than total thickness of gypsum board layers, spaced at 300 mm on center.

3.5.4.3 Fire-Rated Construction

Install gypsum board by means of screws as specified for the tested assembly.

3.5.5 Installation of Backing Board

Install water-resistant backing board on partitions to receive tile, except where glass-mat gypsum backing board is required. Install water-resistant gypsum backing board in accordance with manufacturer's recommendations for installation, including minimum clearance and sealing of penetrations and edges. Do not install water-resistant backing board on ceilings or over vapor retarders.

3.6 INSTALLATION OF TRIM AND ACCESORIES

3.6.1 General

Comply with manufacturer's recommendations for installation of trim items. Except for items intended by manufacturer to be left exposed or semi exposed, install trim units for concealment in joint finishing compound. Wherever possible, fasten metal trim items to substrate with same fasteners used to install gypsum board products.

3.6.2 Corner Bead

Install metal corner bead at all external corners unless details clearly indicate its omission at specific locations.

3.6.3 Edge Trim

Install edge trim at locations indicated and wherever edge of gypsum board otherwise would be exposed.

3.6.4 Control Joints

Install one-piece control joints at required locations. Do not remove tape until finishing operations are complete.

3.7 FINISHING

3.7.1 General

Comply with ASTM C 840 and GA 216 except where exceeded by other requirements. Do not mix joint compounds except as specifically recommended by manufacturer.

3.7.2 Gypsum Board

3.7.2.1 Level 4

All locations, unless otherwise indicated. Embed tape in joint compound at all joints and interior angles. Provide three separate coats of compound at all joints, angles, fastener heads, and accessories. Provide smooth surfaces free of tool marks and ridges.

3.7.2.2 Level 1

From 8 inches above suspended ceilings to top of partitions. Embed tape in joint compound at all joints and interior angles; provide accessories only as detailed. Provide surfaces free of excess joint compound; tool marks and ridges are acceptable.

3.7.2.3 Level 5

Where semigloss or gloss finishes are indicated. Embed tape in joint compound at all joints and interior angles. Provide three separate coats of compound at all joints, angles, fastener heads and accessories. Apply a thin skim coat of joint compound or a special-purpose coating to the entire gypsum board surface. Provide smooth surfaces free of tool marks and ridges.

3.7.2.4 Level 2

Under tile. Embed tape in joint compound at all joints and interior angles. Provide one separate coat of compound at all joints, angles, fastener heads and accessories. Provide surface free of excess joint compound; tool marks and ridges are acceptable.

3.7.3 Joint Treatment

Tape and finish joints in accordance with manufacturer's instructions for

compounds used, using proper hand tools designed for the purpose. Prefill joints at featured edges of gypsum wallboard, using compound recommended by manufacturer of wallboard. Avoid raising nap of face paper when sanding; carefully sponge down any areas roughened by sanding process.

3.7.4 Penetrations

Fill cutouts and openings around fixtures and penetrations with joint compound.

3.7.5 Identification

Identify fire rated partitions above finished ceiling line with stenciled red lettering "FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS". Apply lettering in approximately 38 mm high letters. Space approximately 3 m on center. Apply to both sides of partitions.

3.8 CLEANING

Promptly remove any residual gypsum drywall materials from adjacent or adjoining surfaces, leaving spaces ready for subsequent finishing operations and decorating.

-- End of Section --

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SECTION 09262

HIGH IMPACT GYPSUM FIBER PANELS

04/01

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SECTION 09262

HIGH IMPACT GYPSUM FIBER PANELS
04/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 840 (1999) Application and Finishing of Gypsum Board

UNDERWRITERS LABORATORIES (UL)

UL Fire Resist Dir (2001) Fire Resistance Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-03 Product Data

Fiber reinforced gypsum panels; G ~~REA/E~~

Submit manufacturer's specifications, installation instructions, and general recommendations for each major product required. Include data substantiating that products to be furnished comply with requirements of the contract documents.

1.3 QUALITY ASSURANCE

Obtain required products from a single manufacturer.

1.3.1 Accessories

Provide accessory items only as produced or recommended by manufacturer of primary products.

1.3.2 Fire Resistance Classifications

Where products are installed as part of assemblies with hourly fire resistance ratings, provide materials and installation methods complying

with applicable assembly tested and listed in UL Fire Resist Dir.

1.3.3 Mock-up

Prior to installation of work of this Section, erect sample at location directed by or acceptable to the Contracting Officer, using specified materials and illustrating range of color, texture, and workmanship to be expected in the completed work. Once mock-up has been approved by the Contracting Officer, retain until the work has been completed and accepted.

2. Acceptable mock-up may be incorporated into the final work.

1.4 DELIVERY, STORAGE AND HANDLING

- a. Keep materials dry at all times. Protect against exposure to weather and against contact with damp or wet surfaces.
- b. Protect materials from excessive moisture in shipment, storage, and handling. Deliver materials in manufacturer's unopened packages, and store in dry place with adequate air circulation.
- c. Stack products of this section carefully to provide air circulation within stacks.

PART 2 PRODUCTS

2.1 HIGH IMPACT GYPSUM FIBER PANELS

2.1.1 Fiber-Reinforced Gypsum Panels

2.1.2 Acceptable Products

Products equal to FIBEROCK Brand VHI (Abuse-Resistant) Gypsum Fiber Panels as manufactured by USG. Products by other manufacturers will be considered and may be submitted for approval.

2.1.3 Joint Reinforcement

Products equal to SHEETROCK(r) Brand Joint Tape and SHEETROCK(r) Brand Setting-Type (DURABOND(r) 45 or 90) or Lightweight Setting-Type (EASY SAND(tm) 45 or 90) Joint Compound.

2.1.4 Fasteners

Nails, screws; corrosion resistant, as specified in ASTM C 840.

2.1.5 Framing

For Abuse-Resistant construction, use 20-gauge or heavier studs.

PART 3 EXECUTION

3.1 CUTTING PANELS

- a. Cut ends, edges, scribe, and make cutouts within fields of panels in a workmanlike manner. Panels shall be cut to size utilizing a knife and straight edge. A power saw should be used only if it is equipped with a dust-collection device. Panels may be cut by scoring and snapping, or by sawing, working from the face side.

- b. When using the score-and-snap method, score the panel twice and snap the panel away from the cut face. The backside of the panel is then broken by snapping the panel in the reverse direction.
- c. FIBEROCK VHI panels should be scored and snapped working from the mesh side.
- d. If a power-operated saw is used, a low-RPM, (89 mm) carbon-blade, portable saw is recommended.
- e. Where necessary to obtain neatly fitting joints, a rasp or surform shall be used to smooth cut edges.
- f. Holes for pipes, fixtures, and other small openings can be cut out with a saw or a drywall router equipped with a special bit (available from Rotozip(r) Tool Corporation). When using a router, panels shall be held away from the wall.

3.2 BASIC SINGLE-LAYER SYSTEM, TREATED JOINTS

- a. Position all ends and edges of all gypsum panels over framing members, except when joints are at right angles to framing members, as in perpendicular application or when end joints are back-blocked.
- b. Apply gypsum panels first to the ceiling, then to the walls. Extend ceiling board into corners and make firm contact with top plate. To minimize end joints, use panels of maximum practical lengths. Fit ends and edges closely, but not forced together. Stagger end joints in successive courses with joints on opposite sides of a partition placed on different studs.
- c. Attach panels to framing supports by: (Standard Single Nailing Method) (Double Nailing Method) (Power-Driven Screws). Space fasteners not less than 9.525 mm from edges and ends of panels and drive as recommended for specified fastening method. Drive fasteners in field of panels first, working toward ends and edges. Hold panel in firm contact with framing while driving fasteners. Drive fastener heads slightly below surface of gypsum panels in a uniform dimple.
- d. Fastener Spacing: Refer to manufacturer's data.
- e. Install trim at all internal and external angles formed by the intersection of either panel surfaces or other surfaces. Apply corner bead to all vertical or horizontal external corners in accordance with manufacturer's directions.

3.3 CONTROL JOINT INSTALLATION

Attach Zinc Control Joint No. 93 with 14 mm staples or equivalent spaced not over 152 mm apart in each flange. Cut end joints square and align for neat fit. Remove protective tape when joint treatment is completed. Break panel behind joint and back by double framing members (spaced 12.7 mm apart).

3.4 FASTENER APPLICATION

- a. Drywall Screws: Power-drive with an electric screw gun so screw heads provide a slight depression below surface of gypsum panels. Do not drive screws closer than 9.5 mm from edges and ends of gypsum panels.
- b. Nails: Drive nails with heads slightly below gypsum panel surface in a uniform dimple 0.79 mm deep formed by crowned face of hammer. Drive nails no closer than 9.5 mm from edges and ends of gypsum panels.

3.5 INTERIOR JOINT SYSTEM APPLICATION

- a. Mix joint compound in strict accordance with manufacturer's recommendations. Use only setting type joint compound and SHEETROCK Brand joint tape.
- b. Apply joint compound in a thin uniform layer to all joints and angles to be reinforced. Immediately apply SHEETROCK Brand Joint Tape centered over joint and seated into compound. Sufficient compound-approximately 0.40 mm to 0.79 mm must remain under the tape to provide proper bond. Follow immediately with a thin skim coat to embed tape, but not to function as a second coat. Fold and embed tape properly in all interior angles to provide a true angle. The tape or embedded coat must be hardened prior to application of second coat. Note: Do not use fiberglass tape.
- c. Apply second coat of joint compound over embedding coat, filling panel taper flush with surface; cover tape and feather out at least 50.8 mm beyond first coat. On joints with no taper, cover the tape and feather out at least 102 mm on either side of tape. Allow second coat to harden prior to application of finish coat.
- d. Spread finish coat evenly over and extend at least 50.8 mm beyond second coat on all joints and feather to a smooth uniform finish. Do not allow finished joint to protrude beyond plane of the surface. Apply a finish coat to cover tape and taping compound at all tapered angles and provide a true angle. Where necessary, sand lightly between coats and following the final application of compound to provide a smooth surface ready for decoration. When sanding, take care not to roughen face paper. Always use approved respirator when sanding.

3.6 FINISHING FASTENERS

Apply a setting type compound to fastener depressions.

3.7 FINISHING BEAD AND TRIM

- a. Apply first coat to all bead and trim and properly feather out from ground to plane of surface. Compound must harden prior to application of second coat.
- b. Apply second coat in same manner as first coat, extending compound slightly beyond first coat, and properly feathering from ground to plane or surface. When dry, sand finish as necessary to provide a flat smooth surface ready for decoration. When sanding, take care not to roughen surface.

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SECTION 09310A

CERAMIC TILE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.1A	(1992) Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar
ANSI A108.1B	(1992) Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar
ANSI A108.4	(1992) Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive
ANSI A108.5	(1992) Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
ANSI A108.6	(1992) Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy
ANSI A108.7	(1992) Electrically Conductive Ceramic Tile Installed with Conductive Dry-Set Portland Cement Mortar
ANSI A108.8	(1992) Installation of Ceramic Tile with Chemical Resistant Furan Mortar and Grout
ANSI A108.10	(1992) Installation of Grout in Tilework
ANSI A108.3	(1992) Installation of Membranes for Thin-Set Ceramic Tile
ANSI A118.1	(1992) Dry-Set Portland Cement Mortar
ANSI A118.2	(1992) Conductive Dry-Set Portland Cement Mortar
ANSI A118.3	(1992) Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive

ANSI A118.4	(1992) Latex-Portland Cement Mortar
ANSI A118.5	(1992) Chemical Resistant Furan Mortars and Grouts for Tile
ANSI A118.6	(1992) Ceramic Tile Grouts
ANSI A118.9	(1992) Cementitious Backer Units
ANSI A136.1	(1992) Organic Adhesives for Installation of Ceramic Tile
ANSI A137.1	(1988) Ceramic Tile

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185	(1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM C 33	(1997) Concrete Aggregates
ASTM C 144	(1997) Aggregate for Masonry Mortar
ASTM C 150	(1997) Portland Cement
ASTM C 206	(1984; R 1997) Finishing Hydrated Lime
ASTM C 207	(1991; R 1997) Hydrated Lime for Masonry Purposes
ASTM C 241	(1990) Abrasion Resistance of Stone Subjected to Foot Traffic
ASTM C 373	(1988; R 1994) Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products
ASTM C 648	(1998) Breaking Strength of Ceramic Tile
ASTM C 847	(1995) Metal Lath
ASTM C 1026	(1987; R 1996) Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling
ASTM C 1027	(1984; R 1990) Determining Visible Abrasion Resistance of Glazed Ceramic Tile
ASTM C 1028	(1996) Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
ASTM C 1178/C 1178M	(1996) Glass Mat Water-Resistant Gypsum Backing Panel

TILE COUNCIL OF AMERICA (TCA)

TCA Hdbk	(1997) Handbook for Ceramic Tile
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Installation

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-02 Shop Drawings

Tile layout:~~G-A/E~~

Submit shop drawings indicating tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, thresholds, and setting details. Locate and detail expansion and control joints.

SD-03 Product Data

Tile:~~G-A/E~~

Setting-Bed:~~G-A/E~~

Mortar, Grout, and Adhesive:~~G-A/E~~

Manufacturer's catalog data.

Tile

Mortar and Grout

Manufacturers preprinted installation and cleaning instructions.

SD-04 Samples

Tile:~~G-A/E~~

Accessories:~~G-A/E~~

Samples of sufficient size to show color range, pattern, type and joints.

SD-07 Certificates

Tile

Mortar, Grout, and Adhesive

Certificates indicating conformance with specified requirements. A master grade certificate shall be furnished for tile.

SD-10 Operation and Maintenance Data

Tile and Grout care instructions

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover in accordance with manufacturer's instructions.

1.4 ENVIRONMENTAL REQUIREMENTS

Ceramic tile work shall not be performed unless the substrate and ambient temperature is at least 10 degrees C and rising. Temperature shall be maintained above 10 degrees C while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used they shall be vented to the outside to avoid carbon dioxide damage to new tilework.

1.5 WARRANTY

Submit manufacturer's standard performance guarantees or warranties.

PART 2 PRODUCTS

2.1 TILE

Tile shall be standard grade conforming to ANSI A137.1. Containers shall be grade sealed. Seals shall be marked to correspond with the marks on the signed master grade certificate. Tile shall be impact resistant with a minimum breaking strength for wall tile of 41 kg and 113 kg for floor tile in accordance with ASTM C 648. Tile for cold climate projects shall be rated frost resistant by the manufacturer as determined by ASTM C 1026. Water absorption shall be 0.50 maximum percent in accordance with ASTM C 373.

Floor tile shall have a minimum coefficient of friction of 0.60 wet and dry in accordance with ASTM C 1028. Floor tile shall be Class III-Medium Heavy Traffic, durability classification as rated by the manufacturer when tested in accordance with ASTM C 1027 for abrasion resistance as related to foot traffic.

2.1.1 Mosaic Tile

Color, finish, and size shall be in accordance with the Finish Schedule on the drawings.

2.1.2 Glazed Wall Tile

Glazed wall tile and trim shall be cushion edged with bright glaze. Tile color and size shall be as indicated on the Finish Schedule.

2.2 WATER

Water shall be potable.

2.3 MORTAR, GROUT, AND ADHESIVE

Mortar, grout, and adhesive shall conform to the following:

2.3.1 Dry-Set Portland Cement Mortar

ANSI A118.1.

2.3.2 Conductive Dry-Set Mortar

ANSI A118.2.

2.3.3 Latex-Portland Cement Mortar

ANSI A118.4.

2.3.4 Ceramic Tile Grout

ANSI A118.6; latex-portland cement grout.

2.3.5 Organic Adhesive

ANSI A136.1, Type I.

2.3.6 Epoxy Resin Grout

ANSI A118.3.

2.3.7 Cementitious Backer Board

Cementitious backer units, for use as tile substrate shall be in accordance with ANSI A118.9. Cementitious backer units shall be 12.7 mm thick.

2.3.8 Glass Mat Gypsum Backer Panel

Glass mat water-resistant gypsum backer board, for use as tile substrate shall be in accordance with ASTM C 1178/C 1178M. Glass mat gypsum backer board shall be 12.7 mm thick.

2.4 MARBLE THRESHOLDS

Marble thresholds shall be of size required by drawings or conditions. Marble shall be Group A as classified by MIA Design Manual. Marble shall have a fine sand-rubbed finish and shall be gray in color as approved by the Contracting Officer. Marble abrasion shall be not less than 12.0 when tested in accordance with ASTM C 241.

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

Surface to receive tile shall be inspected and shall conform to the requirements of ANSI A108.1A or ANSI A108.1B for surface conditions for the type setting bed specified and for workmanship. Variations of surface to be tiled shall fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	3 mm in 2.4 meters	3.0 mm in 3 meters
Organic Adhesives	3 mm in 2.4 meters	1.5 mm in 1 meters
Latex portland cement mortar	3 mm in 2.4 meters	3.0 mm in 3 meters
Epoxy	3 mm in 2.4 meters	3.0 mm in 3 meters

3.2 GENERAL INSTALLATION REQUIREMENTS

Tile work shall not be started until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Floor tile installation shall not be started in spaces requiring wall tile until after wall tile has been installed. Tile in colors and patterns indicated shall be applied in the area shown on the drawings. Tile shall be installed with the respective surfaces in true even planes to the elevations and grades shown. Special shapes shall be provided as required for sills, jambs,

recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Tile bases and coves shall be solidly backed with mortar.

3.3 INSTALLATION OF WALL TILE

Wall tile shall be installed in accordance with the TCA Hdbk, method W244.

3.3.1 Dry-Set Mortar and Latex-Portland Cement Mortar

Latex-portland cement shall be used to install tile in accordance with ANSI A108.5. Latex portland cement shall be used when installing porcelain ceramic tile.

3.3.2 Organic Adhesive

Organic adhesive installation of ceramic tile shall conform to ANSI A108.4.

3.4 INSTALLATION OF FLOOR TILE

Floor tile shall be installed in accordance with TCA Hdbk, method F114. Shower receptors, when used, shall be installed in accordance with TCA Hdbk, method B415.

3.4.1 Dry-Set and Latex-Portland Cement

Latex-portland cement mortar shall be used to install tile directly over properly cured, plane, clean concrete slabs in accordance with ANSI A108.5. Latex portland cement shall be used when installing porcelain ceramic tile.

3.4.2 Ceramic Tile Grout

Ceramic Tile grout shall be prepared and installed in accordance with ANSI A108.10.

3.4.3 Waterproofing

Shower pans are specified in Section 15400 PLUMBING, GENERAL PURPOSE.

3.5 INSTALLATION OF MARBLE THRESHOLDS

Thresholds shall be installed where indicated in a manner similar to that of the ceramic tile floor. Thresholds shall be the full width of the opening. Head joints at ends shall not exceed 6 mm in width and shall be grouted full as specified for ceramic tile.

3.6 TESTING

Electrical resistance tests shall be performed on conductive flooring in the presence of the Contracting Officer by a technician experienced in such work and a copy of the test results shall be furnished. Test procedures, testing apparatus, and test results shall be in accordance with the provisions for Conductive Flooring in NFPA 99.

3.7 EXPANSION JOINTS

Joints shall be formed as indicated and sealed as specified in Section 07900 JOINT SEALING.

3.7.1 Walls

Expansion joints shall be provided at control joints in backing material. Wherever backing material changes, an expansion joint shall be installed to separate the different materials.

3.7.2 Floors

Expansion joints shall be provided over construction joints, control joints, and expansion joints in concrete slabs. Expansion joints shall be provided where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 7.2 to 10.8 m each way in large interior floor areas and 3.6 to 4.8 m each way in large exterior areas or areas exposed to direct sunlight or moisture. Expansion joints shall extend through setting-beds and fill.

3.8 CLEANING AND PROTECTING

Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with factory mixed grout shall be cleaned in accordance with instructions of the grout manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a noncorrosive soap or other approved method of protection. Tiled floor areas shall be covered with building paper before foot traffic is permitted over the finished tile floors. Board walkways shall be laid on tiled floors that are to be continuously used as passageways by workmen. Damaged or defective tiles shall be replaced.

-- End of Section --

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SECTION 09445A

RESINOUS TERRAZZO FLOORING

01/96

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SECTION 09445A

RESINOUS TERRAZZO FLOORING
01/96

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. All the latest versions of the referenced publications shall be used.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 56 Flash Point by Tag Closed Tester

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 99 Health Care Facilities

NATIONAL TERRAZZO & MOSAIC ASSOCIATION (NTMA)

NTMA Info Guide Terrazzo Information Guide

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-02 Shop Drawings

Detail Drawings;~~G-A/E~~
Strips;~~G-A/E~~
Control Joint Strips;~~G-A/E~~

Drawings indicating the type, size, and layout of divider strips and control joint strips.

SD-03 Product Data

Resin;~~G-A/E~~
Mixing, Proportioning, and Installation;~~G-A/E~~
Cleaning and Sealing

Resin manufacturer's descriptive data, mixing, proportioning, and installation instructions. Maintenance literature for terrazzo cleaning and sealing shall be included.

SD-04 Samples

Resinous Terrazzo Flooring;~~G-A/E~~

Two 150 x 150 mm, (minimum) samples of each color of resinous terrazzo and two 150 mm lengths, of each type of strip. Color samples of the Criminal Investigation Division logo shall be provided.

SD-07 Certificates

Conductive Resinous Terrazzo Flooring

Certificates indicating conformance with specified requirements. Certificates shall be accompanied by certified test reports showing that the conductive resinous terrazzo floor has been tested and meets the requirements specified.

1.3 GENERAL

Resinous terrazzo flooring, in the colors indicated, shall be applied in the areas shown on the detail drawings. Flooring shall be an epoxy terrazzo system that conforms to the requirements specified in paragraphs 2.01A and B of NTMA Info Guide.

1.4 QUALIFICATION OF APPLICATOR

Applicator shall be approved by the resin manufacturer and shall have a minimum of 3 years experience in the application of the materials to be used and shall have completed 8 successful installations within the past 2 years.

1.5 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers. Materials shall be kept in a clean, dry, area with temperatures controlled between 10 to 33 degrees C.

1.6 ENVIRONMENTAL REQUIREMENTS

Areas to receive terrazzo shall be maintained at a temperature above 10 degrees C for 2 days prior to installation and for 7 days following installation.

PART 2 PRODUCTS

2.1 PRIMER

Primer shall be a material recommended by the resin manufacturer which will penetrate the pores of the substrate and bond with the topping to form a permanent monolithic bond between the substrate and the topping.

2.2 RESIN

Resin for the specified terrazzo flooring shall conform to the requirements shown in NTMA Info Guide.

2.3 FILLERS

Fillers, if required, shall be inert mineral or cellulosic material as recommended by the manufacturer and best suited for the resin binder used. Fillers shall be furnished in the quantity necessary to impart the required

color and physical characteristics.

2.4 MARBLE CHIPS

Marble chips shall be of domestic origin of sizes and colors to produce colors indicated in the Finish Schedule on the drawings. Colors shall be custom and will be installed in accordance with custom samples. Chips shall be a range of sizes up to and including the NTMA Standard No. 0 and Standard No. 1 for 6 mm thick floors and Standard No. 0 through Standard No. 2 for 10 mm thick floors.

2.5 STRIPS

2.5.1 Divider Strips

Divider strips shall be depth as required, 10 mm and of brass.

2.5.2 Control Joint Strips

Control joint strips shall be depth as required, 10 mm and of brass. Control joint filler shall be 100 percent solids, flexible, grindable epoxy joint filler in an approved color to match the terrazzo system.

2.6 GROUT

Grout shall be as recommended by the manufacturer of the resin.

2.7 SEALER

Sealer shall have a pH factor between 7 and 10 and shall be a penetrating type specially prepared for use on terrazzo. The sealer shall not discolor or amber the terrazzo and shall produce a slip resistant surface. Flash point of sealer shall be a minimum of 27 degrees C when tested in accordance with ASTM D 56.

2.8 Flexible Epoxy Membrane

100% solids for crack preparation.

Tensile Strength	1500 psi	ASTM D 2370, 20 degrees C
Elongation	130%	ASTM D 2370, 20 degrees C

PART 3 EXECUTION

3.1 PREPARATION OF CONCRETE SUBFLOOR

Coordinate concrete slab installation requiring a reinforced vapor barrier. Installation of the floor topping shall not commence until the concrete substrate is at least 28 days old. The concrete surfaces shall be prepared in accordance with the instructions of the resin manufacturer.

Prepare concrete substrate to "open" surface pores by means of vacuum blasting or terrazzo grinding. Remove all contaminating or bond breaking substances including but not limited to dust, laitance, curing compounds, coatings, sealers, oil and grease. Any oil or grease not removed by vacuum blasting must be chemically removed. All spalled or deteriorated concrete shall be mechanically removed by scabbling or chipping hammers. Acid etching is not acceptable. Repair damaged concrete with products from terrazzo resin manufacturer. Latex fills or self leveling underlayments

are not acceptable.

3.2 MIXING, PROPORTIONING, AND INSTALLATION

Mixing, proportioning, and installing shall be in accordance with the approved instructions of the manufacturer. Strips shall be installed in locations indicated. The topping shall be applied to give a finish thickness of 10 mm. Bases shall be cove type cast-in-place with 25.4 mm radius cove and shall be 100 mm high.

Cracks and non-expansion joints:

1. Type 1 - Hairline cracks shall receive detail coat of epoxy primer with 76.2 mm fiberglass tape.
2. Type 2 - Fill cracks greater than hairline but less than 1.59 mm wide after surface preparation with neat, Epoxy Membrane. Place detail coat of Membrane over crack and embed 152.4 mm fiberglass cloth. Lightly abrade or solvent wipe treated cracks prior to applying primer.
3. Type 3 - Fill cracks greater than 1.59 mm with Membrane. Place 25-30 mil detail coat so that Membrane extends at least 228.6 to 304.8 mm on each side of crack or joint. After Membrane has leveled, lay precut Membrane Fabric into wet Membrane. Smooth cloth with a flat steel trowel, allowing cloth to be encapsulated but remain exposed on the surface of Membrane. Lightly abrade or solvent wipe treated cracks prior to applying primer.
4. Control Joints: Place back to back angle divider strips directly over concrete control and non-doweled construction joints leaving a space appropriate for anticipated movement - typically 6.35 mm - 9.525 mm. Fill gap between control joints with flexible, grindable epoxy joint sealant. In some cases, where at least 95% concrete shrinkage has already taken place and little joint movement is anticipated, concrete control joints may be optionally covered with Type 3 crack treatment as listed above. While this type of control joint treatment typically eliminates reflective cracking, where climate control is not yet functional and slab temperature variations are anticipated to exceed -9.4 degrees C prior to or after permanent climate control, a slight hump or indentation may be seen at these locations in the finished terrazzo surface.

3.3 TESTING

Between 30 and 45 days after flooring installation is completed, and prior to its use, the conductive resinous terrazzo flooring shall be tested in accordance with paragraph 12-4.1.3.8(b)(7) of NFPA 99. The resistance of the conductive floor at any one location shall be more than 5,000 ohms in areas with 110 volts service, more than 10,000 ohms in areas with 220 volt service, and average less than 1,000,000 ohms and more than 25,000 ohms in all areas.

3.4 CLEANING AND SEALING

The terrazzo shall be washed with a neutral cleaner and where required shall be cleaned with a fine abrasive to remove stains or cement smears. The cleaned surfaces shall be rinsed. When dry, a terrazzo sealer shall be

applied in accordance with the manufacturer's directions.

3.5 PROTECTION

The terrazzo work shall be covered and protected from damage until completion of the work of all other trades.

-- End of Section --

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SECTION 09510

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04/01

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SECTION 09510

ACOUSTICAL CEILINGS

04/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. All the latest versions of the referenced publications shall be used.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 635	Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C 636	Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM E 119	Fire Tests of Building Construction and Materials
ASTM E 580	Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Moderate Seismic Restraint
ASTM E 1264	Standard Classification for Acoustical Ceiling Products
ASTM E 1414	Standard Test for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum

ENGINEERING TECHNICAL INSTRUCTIONS AND ENERGY SAVINGS ANALYSIS

TI 809-04	Seismic Design for Buildings
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UNDERWRITERS LABORATORIES (UL)

UL Fire Resist Dir	Fire Resistance Directory (2 Vol.)
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1.2 SUBMITTALS

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*8

SD-03 Product Data

- a. Acoustical units
- b. Suspension system

SD-07 Certificates

- a. Fire endurance
- b. Ceiling sound transmission class

Test reports by an independent testing laboratory attesting that acoustical ceiling systems meet specified sound transmission requirements.

SD-04 Samples

- a. Acoustical units: ~~C A/E~~

Two samples of each type of acoustical unit showing texture, finish, and color.

1.3 DESIGN CRITERIA FOR CEILING SYSTEM

1.3.1 Ceiling Attenuation Class

The ceiling attenuation class (CAC) of the ceiling system shall be 35 for APC-1 and APC-2 when determined in accordance with ASTM E 1414. Provide fixture attenuators over light fixtures and other ceiling penetrations, and provide acoustical blanket insulation adjacent to partitions, as required to achieve the specified CAC. Test ceiling shall be continuous at the partition and shall be assembled in the suspension system in the same manner that the ceiling will be installed on the project.

1.3.2 Ceiling Sound Absorption

Determine the NRC in accordance with ASTM C 423 Method of Test. Reach a STC 50 rating in assemblies as detailed.

1.3.3 Light Reflectance

Determine light reflectance factor in accordance with ASTM E 1477 Test Method.

1.3.4 Fire Endurance

ASTM E 119 and UL Fire Resist Dir.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be carefully handled and stored in dry, watertight enclosures. Immediately before installation, acoustical units shall be stored for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.5 ENVIRONMENTAL CONDITIONS

For 24 hours before, during, and 24 after installation of acoustical units, maintain temperature and relative humidity at typical in-service conditions. Interior finish work such as plastering, concrete, and terrazzo work shall be completed and dry before installation. Mechanical, Electrical, and other work above the ceiling line shall be completed and approved prior to the start of acoustical ceiling installation.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Acoustical Units

ASTM E 1264, with recycled material content of 10 percent minimum, and the following requirements:

2.1.1.1 Composition Lay-In Panels

- a. Type IV (Non-asbestos) mineral fiber with acoustically transparent membrane. Color: White.
- b. Form 2.
- c. Class A, flame spread 25 or less.
- d. Pattern: E.
- e. Noise Reduction Coefficient (NRC) Grade: 0.75.
- f. Light Reflectance (LR) Coefficient: 0.89.
- g. Nominal Size: 600 by 600 mm.
- h. Edge Detail: Beveled Tegal.

2.1.1.2 Composition Lay-In Panels (Room 315)

- a. Type IV (Non-asbestos) mineral fiber with nonperforated vinyl faced membrane. Color: White.
- b. Form 2.
- c. Class A, flame spread 25 or less.
- d. Pattern: E.
- e. Noise Reduction Coefficient (NRC) Grade: 0.10.
- f. Light Reflectance (LR) Coefficient: 0.83.
- g. Nominal Size: 600 by 600 mm.
- h. Edge Detail: Square.

2.1.1.3 Composition Lay-In Tile

- a. Type III (Non-asbestos) mineral composition with factory-applied standard washable painted finish. Color: White.

- b. Form 2.
- c. Class A, flame spread 25 or less.
- d. Pattern: CE.
- e. Noise Reduction Coefficient (NRC) Grade: 0.55.
- f. Light Reflectance (LR) Coefficient: 0.84.
- g. Nominal Size: 300 by 300 mm.
- h. Edge Detail: Angled Tegular.

2.1.1.4 Perforated Metal Panels

Elliptical or round panel assemblies installed on snap-in concealed grid system as specified.

- a. Metal panels shall be die formed from single sheet steel, 0.45 mm thick, with a black acoustical fleece backing. Provide 50 mm horizontal and 125 mm vertical edge band all around.
- b. Perforations: 3.5 mm round holes at 6 mm centers, for 28 percent open area.
- c. Finish: Silver grey.
- d. Support system: Threaded hanger rods as specified herein, or manufacturer's standard system.

2.1.1.5 Eggcrate Ceiling Panels

13 mm x 13 mm polystyrene plastic cube louvers with square edge profile. Mirror finish.

2.2 SUSPENSION SYSTEM

- a. Type: Exposed and concealed spline grids as scheduled and as detailed on the drawings. ASTM C 635.
- b. Structural Classification: Intermediate duty for main runners and cross tees.
- c. Finish: Surfaces exposed to view shall be of uniform width and shall be steel with factory applied white baked enamel finish.
- d. Accessories: Provide manufacturer's standard hold down clips and wall or edge moldings.
- e. Seismic Requirements: ASTM E 580 and TI 809-4.

2.2.1 Hangers

2.2.1.1 Wires

ASTM A 641/A 641M, Class 1, 2.7 mm in diameter.

2.2.1.2 Rods

5 mm diameter threaded steel rods, zinc or cadmium coated.

2.3 ACOUSTICAL SEALANT

ASTM C 834, nonstaining.

2.4 IDENTIFICATION OF ACCESS PANELS

Identify ceiling access panel by a number utilizing white identification plates or plastic buttons with contracting numerals. The plates or buttons shall be of minimum 25 mmdiameter and securely attached to one corner of each access unit. Provide a typewritten card framed under glass listing the code identification numbers and corresponding system descriptions listed above. Mount the framed card where directed and furnish a duplicate card to the Contracting Officer. Code identification system shall be as follows:

1. Fire detection/alarm system.
2. Air conditioning controls
3. Plumbing system
4. Heating and steam systems
5. Air conditioning duct system
6. Sprinkler system
7. Intercommunication system
8. Telephone junction boxes

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work.

3.2 INSTALLATION

3.2.1 Suspended Ceilings

ASTM C 636.

3.2.1.1 Hangers

Space hangers 1200 mm on centers each direction. Lay hangers out for each individual room or space. Install additional hangers where required to support framing around beams, ducts, column, grilles and other penetrations through the ceiling. Splayed wires may be used if opposite counter splayed wire of the same angle as first wire is installed and attached to same supporting member. No hanger wires or other loads shall be suspended from underside of metal deck. Where lighting fixtures are supported from the suspended ceiling system, hangers shall be provided at a minimum of four

hangers per fixture and located not more than 150 mm each corner of each fixture. See Section 16510, "Interior Lighting" for additional lighting installation requirements.

3.2.1.2 Suspension Members

Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span.

3.2.1.3 Acoustical Tiles

Edges of ceiling tiles shall be in close contact with metal supports and in true alignment. Arrange units so that units less than 1/2 width are minimized.

3.2.1.4 Wall or Edge Molding

Install wall molding at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Secure molding within 75 mm from edges of each length and not more than 400 mm on center between end fastenings.

3.2.1.5 Hold Down Clips

Provide hold down clips for all panels in ceiling system around troffer lights.

3.2.1.6 Caulking

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings. See Section 07900 "Joint Sealers".

3.2.1.7 Seismic Restraint System

Provide seismic restraint for the suspension system in accordance with ASTM E 580.

3.3 CLEANING

Following installation, dirty or discolored surfaces of acoustical units shall be cleaned and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

3.4 MAINTENANCE MATERIAL (EXTRA STOCK)

Furnish one spare acoustical unit for each 100 units installed.

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SECTION 09650A

RESILIENT FLOORING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2240	(199el) Rubber Property - Durometer Hardness
ASTM D 4078	(1992; R 1996) Water Emulsion Floor Polish
ASTM E 648	(1999) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
ASTM E 662	(1997) Specific Optical Density of Smoke Generated by Solid Materials
ASTM F 1303	(1999) Sheet Vinyl Floor Covering with Backing
ASTM F 1700	(1999) Solid Vinyl Floor Tile
ASTM F 2034	Standard Specification for Sheet Linoleum Floor Covering
ASTM F 150-91	Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring
EOS/ESD-S7.1	(1994) Electrical Overstress/Electrical Discharge Association (EOS/ESD) - Floor Material - Resistive Characterization of Materials

1.2 FIRE RESISTANCE REQUIREMENTS

Flooring in corridors and exits shall have a minimum average critical radiant flux of 0.45 watts per square centimeter when tested in accordance with ASTM E 648. The smoke density rating shall be less than 450 when tested in accordance with ASTM E 662.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-03 Product Data

Resilient Flooring and Accessories;~~C A/E~~

Manufacturer's descriptive data and installation instructions including cleaning and maintenance instructions.

SD-04 Samples

Flooring;~~C A/E~~

Three samples of each indicated color and type of flooring and base. Sample size shall be minimum 60 x 100 mm.

SD-06 Test Reports

Moisture Test

Copies of test reports showing that representative product samples of the flooring proposed for use have been tested by an independent testing laboratory within the past three years or when formulation change occurred and conforms to the requirements specified.

SD-10 Operation and Maintenance Data

Submit manufacturer's care instructions for resilient flooring and accessories.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers bearing the manufacturer's name, project identification, and handling instructions. Materials shall be stored in a clean dry area with temperature maintained above 21 degrees C for 2 days prior to installation, and shall be stacked according to manufacturer's recommendations. Materials shall be protected from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances.

1.5 ENVIRONMENTAL REQUIREMENTS

Areas to receive resilient flooring shall be maintained at a temperature above 21 degrees C and below 38 degrees C for 2 days before application, during application and 2 days after application. A minimum temperature of 13 degrees C shall be maintained thereafter.

1.6 SCHEDULING

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

1.7 WARRANTY

Submit manufacturer's standard performance guarantees or warranties.

1.8 EXTRA MATERIALS

Extra flooring material of each color and pattern shall be furnished at the rate of 5 tiles for each 1000 tiles and 0.5 m square meters for each 92 square meters of sheet flooring installed. Extra materials shall be from the same lot as those installed. Extra base material composed of 6 m of each color shall be furnished.

PART 2 PRODUCTS

2.1 SHEET VINYL FLOORING TYPE (VS)

Sheet vinyl flooring shall be composed of a homogeneous, vinyl composition. Flooring shall be not less than 1800 mm wide. Sheet vinyl flooring without backing shall meet the overall thickness 2.03 mm, composition, flexibility, indentation, and the solvent resistance requirements of ASTM F 1303, Type II. The solid vinyl color and pattern shall extend through the total thickness of the material. High quality vinyl welding rods for heat welding of joints shall be provided.

2.2 ELECTROSTATIC CONDUCTIVE/STATIC DISSIPATIVE VINYL TILE (DT)

Electrostatic conductive/static dissipative vinyl tile shall conform to ASTM F 1700. Test reports shall be in accordance with ASTM 150-91 and meet EOS/ESD-S7.1 for the material specified. Tile shall be 61 cm square by 2 mm thick. Tiles shall be of solid un laminated construction. Electrical resistance shall be 10^6 to 10^8 ohms.

2.3 SHEET LINOLEUM FLOORING (LN)

Linoleum floor shall conform to ASTM F 2034. Flooring shall be not less than 2.0 m wide. Thickness of linoleum flooring shall be 2.5 mm.

2.4 RUBBER WALL BASE

Base shall be manufacturers standard rubber, coved style. Base shall be 100 mm high and a minimum 3 mm thick, and not less than 30 m long. Base shall be roll goods. Preformed outside and inside corners shall be furnished.

2.5 INTEGRAL COVED BASE

A vinyl square cap strip and vinyl, rubber, or wood fillet strip with a minimum radius of 19 mm shall be provided for integral coved bases as shown.

2.6 RESILIENT ACCESSORIES

A rubber transition strip tapered to meet abutting material shall be provided when two different materials meet. Reference ASTM D 2240.

2.7 INSTALLATION ACCESSORIES

- A. Adhesive for flooring and wall base shall be water-resistant type as recommended by the flooring manufacturer, to suit substrate conditions and resilient products.
- B. Troweling and leveling compound shall be latex-modified, portland

cement-based formulation, provided by flooring manufacturer for application indicated.

- C. Metal edge strip shall be extruded aluminum with mill finish of width and height required, to protect the exposed edge of vinyl composition tiles or sheet vinyl floor coverings, and in maximum available lengths to eliminate running joints.
- D. Heat welding bead shall be a solid strand product of floor covering manufactured for heat welding seams. The color and pattern shall match that of the sheet vinyl flooring.
- E. The cove strip shall be a 25 mm radius support for integral flash cove base, provided by the floor covering manufacturer.
- F. The cove-base cap strip shall be a square metal, vinyl, or rubber-cap for integral flash cove-base, provided by floor covering manufacturer.

2.8 POLISH

Polish shall conform to ASTM D 4078.

2.9 CAULKING AND SEALANTS

Caulking and sealants shall be in accordance with Section 07900 JOINT SEALING.

2.10 MANUFACTURER'S COLOR AND TEXTURE

Color and texture shall be in accordance with the Finish Schedule.

PART 3 EXECUTION

3.1 EXAMINATION/VERIFICATION OF CONDITIONS

The Contractor shall examine and verify that site conditions are in agreement with the design package and shall report all conditions that will prevent a proper installation. The Contractor shall not take any corrective action without written permission from the Government.

3.2 SURFACE PREPARATION

Flooring shall be in a smooth, true, level plane, except where indicated as sloped. Before any work under this section is begun, all defects such as rough or scaling concrete, low spots, high spots, and uneven surfaces shall have been corrected, and all damaged portions of concrete slabs shall have been repaired as recommended by the flooring manufacturer. Concrete curing compounds, other than the type that does not adversely affect adhesion, shall be entirely removed from the slabs. Paint, varnish, oils, release agents, sealers, waxes, and adhesives shall be removed, as recommended by the flooring manufacturer.

3.3 MOISTURE TEST

The suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content shall be determined by a moisture test as recommended by the flooring manufacturer.

3.4 INSTALLATION OF SOLID VINYL TILE

Tile flooring shall be installed with adhesive in accordance with the manufacturer's installation instructions. Tile lines and joints shall be kept square, symmetrical, tight, and even. Edge width shall vary as necessary to maintain full-size tiles in the field, but no edge tile shall be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Edge tile shall be cut, fitted, and scribed to walls and partitions after field flooring has been applied. At electrostatic conductive/static dissipative flooring, provide one (1) 914.4 mm long grounding strap for every 46.5 sq m of flooring.

3.5 INSTALLATION OF SHEET VINYL FLOORING AND LINOLEUM FLOORING

Sheet vinyl and linoleum flooring shall be installed with adhesive in accordance with the manufacturer's written installation instructions. Flooring shall be fitted to the room by hand cutting, straight scribing, or pattern scribing as necessary to suit job conditions. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Seams shall be cut by overlapping or underscribing as recommended by the manufacturer. Seams and edges of sheet vinyl flooring in room areas shown on the drawings shall be bonded or welded as recommended by the manufacturer. Sheet Vinyl Flooring shall be installed with an integral coved base. Provide set on rubber base of linoleum flooring.

3.6 INSTALLATION OF FEATURE STRIPS

Edge strips shall be secured with adhesive as recommended by the manufacturer. Edge strips shall be provided at locations where flooring termination is higher than the adjacent finished flooring, except at doorways where thresholds are provided.

3.7 INSTALLATION OF RESILIENT BASE

Wall base shall be installed with adhesive in accordance with the manufacturer's written instructions. Base joints shall be tight and base shall be even with adjacent resilient flooring. Voids along the top edge of base at masonry walls shall be filled with caulk.

3.8 INSTALLATION OF INTEGRAL COVED BASE

Integral coved base shall be formed by extending the flooring material 100 mm onto the wall surface. Cove shall be supported by a plastic, rubber or wood coved filler having a minimum radius of 19 mm. Coved base shall be installed with adhesive in accordance with the manufacturer's written instructions. A vinyl cap strip shall be provided at the top of the base. Voids along the top edge of base at masonry walls shall be filled with caulk.

3.9 CLEANING

Immediately upon completion of installation of tile in a room or an area, flooring and adjacent surfaces shall be cleaned to remove all surplus adhesive. After installation, flooring shall be washed with a cleaning solution, rinsed thoroughly with clear cold water, and, except for static control vinyl tile, given two coats of polish in accordance with

manufacturers written instructions. After each polish coat, floors shall be buffed to an even luster with an electric polishing machine. Static control vinyl tile shall be cleaned and maintained as recommended by the manufacturer.

3.10 PROTECTION

From the time of laying until acceptance, flooring shall be protected from damage as recommended by the flooring manufacturer. Flooring which becomes damaged, loose, broken, or curled shall be removed and replaced.

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SECTION 09685

CARPET TILE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 16	(1993) Colorfastness to Light
AATCC 107	(1997) Colorfastness to Water
AATCC 129	(1996) Colorfastness to Ozone in the Atmosphere under High Humidities
AATCC 134	(1996; R 1996) Electrostatic Propensity of Carpets
AATCC 165	(1993) Colorfastness to Crocking: Carpets - AATCC Crockmeter Method

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 418	(1993) Testing Pile Yarn Floor Covering Construction
ASTM D 1335	(1998) Tuft Bind o f Pile Yarn Floor Coverings
ASTM D 1423	(1998) Twist in Yarns by Direct-Counting
ASTM D 2257	(1996) Extractable Matter in Textiles
ASTM D 3936	(1997) Resistance to Delamination of the Secondary Backing of Pile Yarn Floor Covering
ASTM E 648	(1997) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

CODE OF FEDERAL REGULATIONS (CFR)

16 CFR 1630	Surface Flammability of Carpet and Rugs
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CARPET AND RUG INSTITUTE (CRI)

CRI 104	(1996) Standard for Installation of Commercial Carpet
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FEDERAL STANDARDS (FED-STD)

FED-STD-501 (Rev. A) Floor Coverings, Resilient,
Nontextile: Sampling and Testing

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 2551 (1981) Man-made Textile Floor Coverings -
Determination of Dimensional Changes Due
to the Effect of Varied Water and Heat
Conditions (AACHEN Test)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 99 (1996) Health Care Facilities

NFPA 101 (1997) Life Safety Code

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal
Procedures."

*8

SD-02 Shop Drawings

Carpet tile installation: ~~C-A/E~~

Submit drawings that include area to be carpeted; moldings and
edge strips and location; details of special treatments, such as
ducts and trench headers and location.

SD-04 Samples

Carpet Tile

Submit two carpet tiles illustrating color and pattern design for
each carpet color selected.

SD-06 Test Reports

Flammability

Static control

CRI Green Label Requirements for Indoor Air Quality Test Criteria

ADA requirements

The reports shall be dated within two years of submittal for
approval.

SD-07 Certificates

Installation experience

Carpet tile

Submit certificates attesting that the carpet tile meets the
requirements of the paragraphs entitled "Flammability," "ADA
Requirements," and "Indoor Air Quality."

SD-08 Manufacturer's Instructions

Carpet tile installation

Submit the carpet manufacturer's printed installation instructions. Include procedures for installation covering preparation of the substrate, seaming techniques, and recommended adhesives and tapes where applicable.

SD-10 Operation and Maintenance Data

Carpet tile, Data Package 1

Submit data package in accordance with Section 01700, "Operation and Maintenance Data." Submit copies of the manufacturer's maintenance manual.

1.3 INSTALLATION REQUIREMENTS

1.3.1 Experience

All work shall be done by installation firms specializing in commercial carpet installation. The firm shall be a member of the Floor Covering Installation Contractor's Association (FCICA) or certified by the Floor Covering Installation Board (FCIB).

1.3.2 Certificate

Submit certificate from the Contractor attesting that the installation supervisor has had a minimum of 5 years experience in this type of work and will provide qualified, experienced installers to perform work. Include a list of previous jobs giving name, location, dollar value, and date, setting forth supervisor's installation experience.

1.4 DELIVERY AND STORAGE

Deliver carpet tile to the site in manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, and related information. Attach register number or stencil on carton. Store in a safe, dry, clean, and well ventilated area. Do not open containers until needed for installation unless verifying inspection is required. Do not stock more than eight cartons high.

1.5 SAFETY

Carpet adhesives may contain toxic volatile components. Follow ventilation, personal protection, and other safety precautions as recommended by the manufacturer of the adhesive.

1.6 REGULATORY REQUIREMENTS

1.6.1 Indoor Air Quality

Carpet shall bear the Carpet and Rug Institute (CRI) Indoor Air Quality (IAQ) label. Carpet type bearing the label will indicate that the carpet has been tested and meets the criteria of the CRI Green Label Requirements for Indoor Air Quality Test Criteria.

1.6.2 ADA Requirements

Carpet shall meet the ADA requirements as follows:

If carpet tiles are used on a ground or floor surface, then it shall be securely attached; have a firm cushion, pad, or backing, or no cushion or pad; and have a level loop, textured loop, level cut pile, or level cut/uncut pile texture. The maximum thickness shall be 13 mm. Exposed edges of carpet shall be fastened to floor surfaces and have trim along the entire length of the exposed edge.

PART 2 PRODUCTS

2.1 PHYSICAL REQUIREMENTS

Provide carpet tile from manufacturer's standard stock. Carpet shall be first quality; and free of visual blemishes, streaks, poorly dyed areas, and other physical and manufacturing defects. Use nontoxic carpet materials and treatments, reasonably nonallergenic, and free of other recognized health hazards. Provide carpet tile of tufted construction with a secondary backing of vinyl or prereacted polyurethane hardback, or a woven polypropylene fabric with a thermoplastic mixture of ethylene/vinyl acetate polymer and a hydrocarbon resin (hot melt). Carpet tile shall be of the modular type, identical in size, precision die cut for complete interchangeability. Sides shall be straight and the corners square. Tufts shall be firmly secured at the edges as in the other areas of the carpet tile. Carpet tile must lay flat on a flat surface without curling, warping, buckling, cupping, or doming and without any lumpiness, unevenness, or differences in thickness in individual tiles or from tile-to-tile. Provide carpet tile that does not stretch or shift position in use when installed according to the carpet tile manufacturer's instructions. Use nontoxic carpet tile materials and treatment, free from other recognized health hazards, and conforming to the following:

- a. Surface Texture: Tufted.
- b. Pile Yarn Type: Textured Loop.
- c. Pile Fiber: Commercial branded 6.6 Nylon polymer at least 25% recycled fiber.
- d. Finished Pile Yarn Weight: Weight shall be determined in accordance with ASTM D 418.
- e. Pile Density: Minimum 0.21 g/cm³ .
- f. Width: 500 cm x 500 cm.
- g. Gage: 47.2 ends per 10 cm minimum in accordance with ASTM D 418 ASTM D 418.
- h. Dye method: Minimum 80% solution dyed.
- i. Pattern and Color: As indicated in drawings

2.1.1 Surface Texture

2.1.1.1 Loop Pile

Provide either tufted or textured loop pile creating an overall nondirectional surface. Maximum differential finished pile heights (high and low pile loops) of textured pile is 4.6 mm.

2.1.1.2 Tip Shear

Tip-shear-tufted multilevel loop carpet in which the significantly longer loops are lightly sheared. The cut fiber tips showing on the surface against the loop background give darker, or shaded, cut areas and surface interest to the carpet. Yarn used in tufting the tip-shear shall be heat set.

2.1.2 Pile Yarn

Do not use reclaimed yarn fibers from any woven, tufted, knitted, or felted products. Do not use undrawn fiber in spun yarn. Provide spun yarn of at least two ply for loop pile carpet tile. Use yarn setting method sufficient to assure permanent texture retention under normal use conditions, cleaning, and shampooing. Use autoclave or continuous heat process to set yarn in cut pile construction; yarns for fusion bonded plush cut pile may be crimp-set. Fiber denier and staple lengths may be subject to normal manufacturing tolerances with the following limitations:

- a. Acceptable variance in staple length, plus or minus 10 percent.
- b. Acceptable denier variance, plus or minus 10 percent, in individual filament denier and plus or minus 3 percent in average denier.

2.1.2.1 Twist and Twist Multiplier

For loop pile carpet tile, ASTM D 1423. The minimum twist multiplier for singles is 2.75; minimum for a 2-ply yarn is 80 percent of the twist in the singles yarns; for a 3-ply yarn, 70 percent; and for a 4-ply yarn, 60 percent.

2.1.2.2 Staple Nylon

Carpet fiber with average fiber size of 15 denier or coarser and minimum staple length of 150 mm.

2.1.2.3 Continuous Hollow Filament Nylon

Branded, continuous high bulk or textured carpet fiber with average filament size of 15 denier or coarser modified to provide increased translucence or opacity for soil hiding.

2.1.2.4 Polyethylene Terephthalate (PET)

Carpet fiber extruded and spun from at least 25 percent recycled polyethylene terephthalate (PET) principally derived from post consumer soft drink bottles.

2.1.2.5 Extractable Matter in Finished Yarn

Not more than two percent when tested in accordance with ASTM D 2257.

2.1.3 Primary Carpet Backing

Those customarily used and accepted by the trade for each type of carpet tile. Use a back coating compound of synthetic resin or natural or synthetic latex compound. Use back coating quantity normally used in the supplier's product.

2.1.4 Secondary Backing

Shall be fiberglass reinforced vinyl hardback for fusion bonded carpet tile. Should be prereacted polyurethane hardback, fiberglass reinforced vinyl hardback, or woven polypropylene fabric adhered with ethylene/vinyl acetate polymer and hydrocarbon resin (hot melt) for woven or tufted carpet tile.

2.1.4.1 Vinyl Hardback

A suitably compounded virgin polymer or copolymer of vinyl chloride resin, plasticized with compatible, primary plasticizers only. Virgin polymer is defined as a polymer or copolymer that has not been processed into a finished product prior to use in the hardback. Primary plasticizers are as plasticizers which are individually and totally compatible with the polymers or copolymers of vinyl chloride resin. Use compound that is uniform and free from objectionable odor, and conforming to the following:

- a. Hardback: Average not less than 2.9 mm in total backing thickness.
- b. Total Weight: Average not less than 4815 g/m².
- c. Compression resistance: Not less than 690 kPa.
- d. Adherence: No separation of the carpet tile and hardback.
- e. Accelerated weathering: No cracking, stiffness, brittleness, soft or tacky and appreciable change in color, when compared to the unexposed sample, after 100 hours in the weatherometer.
- f. Flexibility at 21 degrees C and at minus one degree C: No cracking, flaking, crazing, or show any other indication of failure.
- g. Moisture absorbency: Maximum one percent moisture absorbency, after 4 hours submersion in water at 22 degrees C.
- h. Volatile matter: No more than one percent.

2.1.4.2 Prereacted Polyurethane Hardback

Use a polyurethane fully prereacted thermosetting elastomer made entirely from virgin material and conforming to the following:

- a. Thickness: Average not less than 7.1 mm in thickness.
- b. Weight: Not less than 576.0 g/m².
- c. Adherence: No separation of the carpet tile and cushion.
- d. Accelerated weathering: No cracking, stiffness, brittleness, soft and tacky and no appreciable change in color, compared to the unexposed sample, after 100 hours in the weatherometer.

- e. Flexibility at 21 degrees C and at minus one degree C: No cracking, flaking, crazing, or show any other condition of failure.
- f. Volatile matter: No more than one percent.
- g. Moisture absorbency: Maximum one percent moisture absorbency, after 4 hours submersion in water at 22 degrees C.

2.1.4.3 Hot-Melt Back

A woven polypropylene fabric adhered with a suitable compounded thermoplastic mixture made entirely from virgin ethylene/vinyl acetate polymer and hydrocarbon resin and conforming to the following:

- a. Weight: Not be less than 0.92 kg/m².
- b. Adherence: No separation of the carpet tile and secondary back.
- c. Accelerated weathering: No cracking, stiffness, brittleness, soft and tacky, and no appreciable color change when compared to the unexposed sample, after 100 hours in the weatherometer.
- d. Flexibility at 21 degrees C and at minus one degree C: No cracking, flaking, crazing, or any other condition of failure. See paragraph entitled "Flexibility."
- e. Hot-melt back: Maximum of one percent moisture absorbency, after 4 hours submersion in water at 22 degrees C.

2.2 PERFORMANCE REQUIREMENTS

2.2.1 Dimensional Stability

Dimensional stability shall be maintained at +/-, 0.2 percent maximum in according with ISO 2551 (AACHEN Test).

2.2.2 Delamination Strength

Delamination strength for turfed carpet with secondary back shall be a minimum of 440 n/m in accordance with ASTM D 3936.

2.2.3 Flexibility

Secondary backing must not crack, flake, craze, or show any other indications of failure when tested as specified below.

2.2.3.1 At 21 Degrees C

Use a 100 by 100 mm specimen. Double the specimen and press flat on itself in any direction. Hold doubled for 5 minutes. Examine for indications of failure while doubled and after pressed flat. Make the examination visually at a distance of 300 mm.

2.2.3.2 At Minus One Degree C

FED-STD-501, Method 6511, using 25 mm mandrel plus or minus 3 mm.

2.2.4 Colorfastness to Light

AATCC 16. Use the Xenon arc as the light source. Consider colors that are deeper or equivalent in hue to Row 2 of the AATCC Color Transference Chart as dark colors; consider those lighter as light colors. Colors for synthetic yarns shall show a gray scale rating of at least 4 for light shades after the equivalent of two L-4 breaks and at least 4 for dark shades after the equivalent of at least three L-4 breaks. Woolen yarns show a gray scale rating of at least 4 for light shades after the equivalent of one L-4 break and at least 4 for dark shades after the equivalent of two L-4 breaks. Base classification on the AATCC Blue Wool Light fastness Standards L-2 to L-9. Test all colors specified. If the Xenon Arc Fadeometer has a built-in continuous monitor and control device made by the manufacturer, the blue wool standards referenced in AATCC 16 need not be used to judge the L-4 breaks, providing the manufacturer's instructions are followed.

2.2.5 Dry and Wet Crocking, Color Fastness to Water and to Ozone

AATCC 165 AATCC 107 AATCC 129. All colors specified shall show a minimum rating of step 4 on the AATCC Color Transference Chart.

2.2.6 Pile Coverage

Sufficient to conceal backing.

2.2.7 Tuft Bind

ASTM D 1335. The minimum tuft bind for loop pile is 4.54 kilograms and for cut pile 2.27 kilograms.

2.2.8 Flammability

In addition to meeting the requirements of CPSC 16 CFR 1630, all carpet tile shall meet the minimum radiant flux requirements of NFPA 101 when tested in accordance with ASTM E 648. Test carpet tile and hardback together, as they will be installed.

2.2.9 Static Control

AATCC 134. Incorporate a permanent static control system to control static build-up to less than 2.0 kV. Test at 20 percent relative humidity at 21 degrees C.

2.2.10 Electrical Resistance

NFPA 99, Chapter 3. Maximum electrical resistance for carpet tile shall be 20,000 megohms measured between the floor surface and building or applicable ground material, and shall provide a resistance of not less than 150 kilo ohms when measured from any point on the floor.

2.3 ADHESIVES

Waterproof, nonflammable, shall be a pressure sensitive releasable adhesive carpet as furnished or recommended by the carpet manufacturer. Use waterproof, nonflammable, and nonstaining seal adhesive as furnished or recommended by the carpet manufacturer. Low emitting volatile organic compound (VOC) adhesive should be used to improve indoor air quality.

PART 3 EXECUTION

3.1 CARPET TILE INSTALLATION

Install carpet tile in accordance with CRI 104 and manufacturer's printed instructions after the work of other trades, including painting, is done. Installed carpet tile must be smooth, uniform, and secure. Install tile in design as indicated on finish plans. Fit cutouts, such as door jams, columns, and ducts, neatly and securely.

3.1.1 Carpet Tile Location

Install carpet tile wall-to-wall in rooms and areas indicated on finish/color schedule and in the finish plans. Include all material indicated, specified, or necessary for a completely finished installation. Contractors responsible for providing carpet of the same dye lot for each type indicated, for the required quantities of carpet and must verify all dimensions in the field as well as other conditions affecting the work.

3.1.2 Extra Carpet Tile

Furnish one carton of carpet tiles or 5%, whichever is greater, of each pattern and color in addition to the quantity required for installation. Furnish extra carpet tile, for replacement use, of same manufacturer, type, dye lot, and quality as the installed carpet tile; provided in original cartons; and properly marked.

3.1.3 Substrate Preparation

Inspect rooms and areas to be carpeted. Before installation, verify that concrete floors comply with requirements on moisture content recommended by adhesive or carpet manufacturer's instructions. Repair holes, cracks, depressions, or rough areas using material recommended by the carpet tile manufacturer. Grind raised areas or ridges smooth and level with surrounding surface. Provide floor free of any foreign materials and swept broom clean. Comply with requirements for conditioning adhesives and minimum floor temperature before, during, and after installation as recommended by the carpet tile and adhesive manufacturer's instructions. However, in no case may floor temperature be less than 16 degrees C for 24 hours prior to, during, and after installation. Do not permit traffic or movement of furniture or equipment in carpeted areas for at least 24 hours after installation. Carpet tile installation constitutes validation by the Contractor that the substrate and conditions in the area meet all requirements for satisfactory installation.

3.1.4 Accessibility

Installed carpet tiles shall be removable. Ensure that the exposed area is capable of being restored to its original condition by replacing the removed tiles or installing new tiles of the same manufacturer, type, and quality.

3.1.5 Molding

Finish carpet tile edges meeting hard surface flooring with moldings. Install in accordance with manufacturer's instructions.

3.2 CLEANING AND PROTECTION

3.2.1 Cleaning

After installation, remove all debris, moldings, scraps, and other foreign matter. Remove any soiled spots or adhesive from the face of the carpet tile with the appropriate spot remover. Clip any protruding face yarn with sharp scissors. Vacuum the carpet tile until clean.

3.2.2 Protection

Carefully protect installed carpet tile with heavy, reinforced, nonstaining kraft building paper or polyethylene film of an approved quality and thickness. Lap and secure edges of covering widths. Keep covering in repair and replace damaged portions. Remove protective covering when directed by the Contracting Officer.

-- End of Section --

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SECTION 09720A

WALLCOVERINGS
04/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 423	(1999a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E 84	(1999) Surface Burning Characteristics of Building Materials
ASTM F 793	(1993; R 1998) Standard Classification of Wallcovering by Durability Characteristics

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-03 Product Data

Wallcoverings;~~C-A/E~~
Manufacturer's Instructions;~~C-A/E~~

Manufacturer's descriptive data, documentation stating physical characteristics, flame resistance, mildew and germicidal characteristics.

Installation

Preprinted installation instructions for wallcovering and accessories.

Maintenance
Clean-Up

Preprinted cleaning and maintenance instructions for wallcovering and accessories.

SD-04 Samples

Wallcoverings

Three samples of each indicated type, pattern, and color of wallcovering. Samples of wall covering shall be minimum 125 x 175 mm and of sufficient size to show pattern repeat. Three samples of each indicated type corner guard and wainscot cap.

SD-07 Certificates

Wallcoverings

Manufacturer's statement attesting that the product furnished meets or exceeds specification requirements. The statement must; be dated after the award of the contract, state Contractor's name and address, name the project and location, and list the requirements being certified.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in manufacturers original unopened containers labeled with manufacturers name, pattern, texture, size and related information. Materials shall be stored in accordance with the manufacturer's instructions in a clean dry ventilated area with temperature maintained above 16 degrees C for two days prior to installation.

1.4 ENVIRONMENTAL REQUIREMENTS

Areas to receive wallcovering shall be maintained at a temperature above 16 degrees C for 7 days before, during, and 7 days after application.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one-year period shall be provided.

1.6 EXTRA MATERIALS

Extra material from the same dye lot consisting of 0.5 m of full-width wallcovering for each 30 linear meters of wallcovering installed shall be provided for maintenance.

PART 2 PRODUCTS

2.1 WALLCOVERINGS

Wallcoverings shall be material designed specifically for the specified use. The wallcovering shall contain a non-mercury based mildewcide. The wallcovering shall be type made without the use of cadmium based stabilizers. Wallcovering shall have a Class A flame spread rating of 0-25 and smoke development rating of 0-50 when tested in accordance with ASTM E 84.

2.1.1 Vinyl Wallcovering Type II

Vinyl wallcovering shall be a vinyl coated woven or nonwoven fabric with germicidal additives and shall conform to ASTM F 793, Category Type II, (0.445 to 0.815 kg) total weight per square meter and width of 1372 mm.

2.1.2 Fabric Wallcovering

Fabric wallcovering shall be a woven fabric with paper or acrylic backing and shall be colorfast, stain, and soil resistant. Fabric wallcovering shall meet or exceed the following:

- a. Face fiber content: 100% Recycled Solution-Dyed Polyester.
- b. Total weight: 651 kg/square meter.
- c. Width: 1676 mm.

2.2 CORNER GUARDS

Corner guards shall be 2 mm thick and shall cover 19 mm each side of corner at right angles. Corner guards shall be stainless steel from the same lot and color.

2.3 PRIMER AND ADHESIVE

Primer and adhesive shall be of a type recommended by the wallcovering manufacturer and shall contain a non-mercury based mildewcide. Adhesive shall be strippable type. Adhesive to install cap shall be of a type recommended by the manufacturer of the wainscot cap.

2.4 COLOR, TEXTURE, AND PATTERN

Color, texture, and pattern shall be in accordance with the Finish Schedule on the drawings.

PART 3 EXECUTION

3.1 EXAMINATION

Contractor shall inspect all areas and conditions under which wallcoverings are to be installed. Contractor shall notify in writing of any conditions detrimental to the proper and timely completion of the installation. Work will proceed only when conditions have been corrected and accepted by the installer.

3.2 SURFACE PREPARATION

Wallcovering shall not be applied to surfaces that are rough, that contain stains that will bleed through the wallcovering, or that are otherwise unsuitable for proper installation. Cracks and holes shall be filled and rough spots shall be sanded smooth. Surfaces to receive wallcovering shall be thoroughly dry. Plaster surfaces shall age at least 30 days prior to installation of vinyl wallcoverings. Interior surfaces of exterior masonry walls shall be sealed to prevent moisture penetration, then primed with a wallcovering primer in accordance with the manufacturer's instructions. Moisture content of plaster, concrete, and masonry shall be tested with an electric moisture meter and reading shall be not more than 5 percent. Masonry walls shall have flush joints. Concrete and masonry walls shall be coated with a thin coat of joint compound or cement plaster as a substrate preparation. To promote adequate adhesion of wall lining over masonry walls, the walls shall be primed as recommended by the wall lining manufacturer. Surface of walls shall be primed as required by manufacturer's instructions to permit ultimate removal of wallcovering from the wall surface. Primer shall be allowed to completely dry before adhesive application.

3.3 INSTALLATION

3.3.1 Vinyl and Fabric Wallcovering

Wallcovering shall be installed in accordance with the manufacturer's installation instructions. Glue and adhesive spillage shall be immediately removed from wallcovering face and seams with a remover recommended by the manufacturer. After the installation is complete, the fabric wallcovering shall be vacuumed with a ceiling to floor motion.

3.3.2 Corner Guards and Wainscot Cap

Corner guards and wainscot cap shall be installed on all exposed corners and in accordance with the manufacturer's printed instructions. Corner guards shall run from top of base to wainscot cap in a continuous length.

3.4 CLEAN-UP

Upon completion of the work, wallcovering shall be left clean and free of dirt or soiling. Surplus materials, rubbish, and debris resulting from the wallcovering installation shall be removed and area shall be left clean.

-- End of Section --

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SECTION 09840

ACOUSTICAL WALL TREATMENT
11/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC TM 16 (1998) Test Method: Colorfastness to Light

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 423 (1999a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM D 1117 (1999) Nonwoven Fabrics

ASTM D 5034 (1995) Breaking Strength and Elongation of Textile Fabrics (Grab Test)

ASTM E 84 (2000a) Surface Burning Characteristics of Building Materials

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

ICBO Building Code (1997) Uniform Building Code (3 Vol.)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-02 Shop Drawings

Detail Drawings:~~G-A/E~~

Drawings showing plan locations, elevations and details. Drawings shall include details of method of anchorage, location of doors and other openings, base detail and shape and thickness of materials.

SD-03 Product Data

Installation:~~G-A/E~~

Manufacturer's installation instructions and recommended cleaning instructions.

Acoustical Wall Panels;~~C-A/E~~

Manufacturer's descriptive data and catalog cuts.

SD-04 Samples

Acoustical Wall Panels;~~C-A/E~~

Manufacturer's standard fabric swatches, minimum 450 mm wide by 600 mm long 2 samples of each color range specified.

SD-07 Certificates

Acoustical Wall Panels;~~C-A/E~~

Certificates of compliance from an independent laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards. A label or listing from the testing laboratory will be acceptable evidence of compliance.

1.3 QUALITY ASSURANCE

Prefabricated panels and site-fabricated systems with sewn seams are not acceptable for this specification. Only systems that allow for fabric replacement without disturbances of adjacent panels will be acceptable.

1.4 DELIVERY AND STORAGE

Materials delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt, dust, or other contaminants.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a two year period shall be provided.

PART 2 PRODUCTS

2.1 FABRIC COVERED ACOUSTICAL WALL PANELS

Site fabricated acoustical fabric wall panels shall consist of seamless fabric covered fiber glass or mineral fiber core system as described below.

Wall panels shall be manufactured to the dimensions and configurations shown on the detail drawings. System to be stretched by means of 25 mm rigid vinyl polymer extrusion with profiles shown on drawings. Acoustical wall panels installed in non-sprinklered areas must comply with the requirements of ICBO Building Code, Standard 42-2.

- a. Panel Width: Panel width shall be as detailed.
- b. Panel Height: Panel height shall be as detailed.
- c. Thickness: Panel thickness shall be as required to meet the indicated NRC range.

- d. Fabric Covering: Seamless non-woven, embossed texture, needle punched 100 percent polyester, minimum 0.034 kg per linear meter. Tear strength shall be minimum 110 N machine direction and minimum 178 N cross-machine direction in accordance with ASTM D 1117. Tensile strength shall be minimum 220 N machine direction and minimum 330 N cross-machine direction in accordance with ASTM D 5034. Light fastness (fadeometer) shall be approximately 40 hours in accordance with AATCC TM 16.
- e. Fire rating for the complete composite system: Class A, 5 or less smoke density and flame spread of 10, when tested in accordance with ASTM E 84.
- f. Substrate: Fiber glass or mineral fiber.
- g. Noise Reduction Coefficient (NRC) Range: 0.80-0.90 ASTM C 423.
- h. Edge Detail: Square edge.
- i. Core Type: Acoustical/tackable core.
- j. Color: Color shall be in accordance with the Finish Schedule on the drawings

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

Walls shall be clean, smooth, oil free and prepared in accordance with panel manufacturer's instructions. Installation shall not begin until all wet work, such as, plastering, painting, and concrete are completely dry.

3.2 INSTALLATION

Site fabricated panel installation shall be by personnel familiar with and normally engaged in installation of acoustical wall panels of this type. Panels shall be applied in accordance with the manufacturer's installation instructions, and as follows:

- a. Fasten the rigid polymer extrusions to the surfaces, which are to receive the treatment using the manufacturer's approved fasteners.
- b. Install rigid polymer extrusions plumb, straight, flush and in proper alignment. See drawings for elevations of extrusion placement.
- c. Install the core material required, continuous and flush to the shoulder of the track and secured in place with recommended fasteners. See drawings for exact core type locations.
- d. Cut the specified fabric maintaining sequence of drop and matching direction of weave for uniform installation.
- e. Stretch the fabric and secure into the locking jaws of the extrusions so that it will be smooth, free of wrinkles and the weave straight and parallel to perimeter anchors, plumb and aligned horizontally and vertically. Gluing or stapling of fabric will not be acceptable for this work.

- f. Examine fabric as it is installed for damage, imperfections, poor color match or other deficiencies. Replace with acceptable material as directed by the Government.

3.3 CLEANING

Following installation, dirty or stained panel surfaces shall be cleaned in accordance with manufacturer's instructions and left free from defects. Panels that are damaged, discolored, or improperly installed shall be removed and new panels provided as directed.

3.4 PROTECTION

Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that acoustical wall panels are without damage or deterioration at the time of completion.

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-- End of Section Table of Contents --

SECTION 09900

PAINTS AND COATINGS

02/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH Limit Values	(1991-1992) Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
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ACGIH TLV-DOC	Documentation of Threshold Limit Values and Biological Exposure Indices
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AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A13.1	Scheme for Identification of Piping Systems
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 235	Standard Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)
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ASTM D 523	(1999) Standard Test Method for Specular Gloss
------------	--

ASTM C 669	(1995) Glazing Compounds for Back Bedding and Face Glazing of Metal Sash
------------	--

ASTM C 920	(1998) Elastomeric Joint Sealants
------------	-----------------------------------

ASTM D 2092	(1995) Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting
-------------	--

ASTM D 2824	(1994) Aluminum-Pigmented Asphalt Roof Coatings, Non-Fibered, Asbestos Fibered, and Fibered Without Asbestos
-------------	--

ASTM D 4214	(1998) Evaluating the Degree of Chalking of Exterior Paint Films
-------------	--

ASTM D 4263	(1983; R 1999) Indicating Moisture in Concrete by the Plastic Sheet Method
-------------	--

ASTM D 4444	(1998) Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters
-------------	---

ASTM F 1869 (1998) Measuring Moisture Vapor Emission
Rate of Concrete Subfloor Using Anhydrous
Calcium Chloride

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.1000 Air Contaminants
29 CFR 1910.1001 Asbestos, Tremolite, Anthophyllite, and
Actinolite
29 CFR 1910.1025 Lead
29 CFR 1926.62 Lead Exposure in Construction

FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1 (Rev J) Obstruction Marking and Lighting

FEDERAL STANDARDS (FED-STD)

FED-STD-313 (Rev. C) Material Safety Data,
Transportation Data and Disposal Data for
Hazardous Materials Furnished to
Government Activities
FED-STD-595 (1989 Rev B) Color

MASTER PAINTERS INSTITUTE (MPI)

MPI 1 (2001) Aluminum Paint
MPI 2 (2001) Aluminum Heat Resistant Enamel (up
to 427 C and 800 F)
MPI 4 (2001) Interior/Exterior Latex Block Filler
MPI 5 (2001) Exterior Alkyd Wood Primer
MPI 6 (2001) Exterior Latex Wood Primer
MPI 7 (2001) Exterior Oil Wood Primer
MPI 8 (2001) Exterior Alkyd, Flat
MPI 9 (2001) Exterior Alkyd Enamel
MPI 10 (2001) Exterior Latex, Flat
MPI 11 (2001) Exterior Latex, Semi-Gloss
MPI 13 (2001) Exterior Semi-Transparent Stain
(Solvent Based)
MPI 16 (2001) Exterior Solid Color Latex Stain
MPI 19 (2001) Inorganic Zinc Primer
MPI 21 (2001) Heat Resistant Enamel, Gloss, (Up to

205 C or 400 F)

MPI 22	(2001) High Heat Resistant Coating
MPI 23	(2001) Surface Tolerant Metal Primer
MPI 26	(2001) Cementitious Galvanized Metal Primer
MPI 27	(2001) Exterior / Interior Alkyd Floor Enamel, Gloss
MPI 31	(2001) Polyurethane, Moisture Cured, Clear Gloss
MPI 39	(2001) Interior Latex-based Wood Primer
MPI 42	(2001) Latex Stucco and Masonry Textured Coating
MPI 44	Interior Latex, Gloss Level 2
MPI 45	(2001) Interior Primer Sealer
MPI 46	(2001) Interior Enamel Undercoat
MPI 47	(2001) Interior Alkyd, Semi-Gloss
MPI 48	(2001) Interior Alkyd, Gloss
MPI 49	(2001) Interior Alkyd, Flat
MPI 50	(2001) Interior Latex Primer Sealer
MPI 51	(2001) Interior Alkyd, Eggshell
MPI 52	(2001) Interior Latex, Gloss Level 3
MPI 54	(2001) Interior Latex, Semi-Gloss
MPI 56	(2001) Interior Alkyd Dry Fog/Fall
MPI 57	(2001) Interior Oil Modified Clear Urethane, Satin
MPI 59	(2001) Interior/Exterior Alkyd Porch & Floor Enamel, Low Gloss
MPI 60	(2001) Interior/Exterior Latex Porch & Floor Paint, Low Gloss
MPI 68	(2001) Interior/Exterior Latex Porch & Floor Paint, Gloss
MPI 71	(2001) Polyurethane, Moisture Cured, Clear, Flat
MPI 72	(2001) Polyurethane, Two Component, Pigmented, Gloss

MPI 77	(2001) Epoxy Cold Cured, Gloss
MPI 79	(2001) Marine Alkyd Metal Primer
MPI 90	(2001) Interior Wood Stain, Semi-Transparent
MPI 94	(2001) Exterior Alkyd, Semi-Gloss
MPI 95	(2001) Fast Drying Metal Primer
MPI 101	(2001) Cold Curing Epoxy Primer
MPI 107	(2001) Rust Inhibitive Primer (Water-Based)
MPI 108	(2001) High Build Epoxy Marine Coating
MPI 110	(2001) Interior/Exterior High Performance Acrylic
MPI 113	(2001) Elastomeric Coating
MPI 116	(2001) Epoxy Block Filler
MPI 119	(2001) Exterior Latex, High Gloss (acrylic)
MPI 134	(2001) Waterborne Galvanized Primer
MPI 138	(2001) High Performance Latex, White and Tints - MPI Gloss Level 2
MPI 139	(2001) High Performance Latex, White and Tints - MPI Gloss Level 3
MPI 140	(2001) High Performance Architectural Latex - Gloss Level 4
MPI 141	(2001) High Performance Semigloss Latex, White and Tints - Gloss Level 5
MPI 144	(2001) Institutional Low Odor / VOC Interior Latex, Gloss Level 2
MPI 145	(2001) Institutional Low Odor / VOC Interior Latex, Gloss Level 3
MPI 146	Institutional Low Odor/VOC Interior Latex - Gloss Level 4 (a 'satin-like' finish)
MPI 147	(2001) Institutional Low Odor / VOC Interior Latex, Gloss Level 5

COMMERCIAL ITEM DESCRIPTION (CID)

CID A-A-2904	Thinner, Paint, Mineral Spirits, Regular and Odorless
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U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101 (Rev. B) Color Code for Pipelines and for
Compressed Gas Cylinders

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS-EPP-SP01-01 (2001) Environmentally Preferable Product
Specification for Architectural and
Anti-Corrosive Paints

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Guide 6 (1997) Containing Debris Generated During
Paint Removal Operations

SSPC Guide 7 (1995) Disposal of Lead-Contaminated
Surface Preparation Debris

SSPC QP 1 (1989) Evaluating Qualifications of
Painting Contractors (Field Application to
Complex Structures)

SSPC PA 1 (2000) Shop, Field, and Maintenance
Painting

SSPC PA 3 (1995) Safety in Paint Application

SSPC VIS 1 (1989) Visual Standard for Abrasive Blast
Cleaned Steel (Standard Reference
Photographs)

SSPC VIS 3 (1993) Visual Standard for Power- and
Hand-Tool Cleaned Steel (Standard
Reference Photographs)

SSPC VIS 4 (2001) Guide and Reference Photographs for
Steel Surfaces Prepared by Waterjetting

SSPC SP 1 (1982) Solvent Cleaning

SSPC SP 2 (1995) Hand Tool Cleaning

SSPC SP 3 (1995) Power Tool Cleaning

SSPC SP 6 (1994) Commercial Blast Cleaning

SSPC SP 7 (1994) Brush-Off Blast Cleaning

SSPC SP 10 (1994) Near-White Blast Cleaning

SSPC SP 12 (1995) Surface Preparation and Cleaning of
Steel and Other Hard Materials by High-and
Ultra high-Pressure Water Jetting Prior to
Recoating

SSPC Paint 18 (1991) Chlorinated Rubber Intermediate
Coat Paint

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

Samples of specified materials may be taken and tested for compliance with specification requirements.

In keeping with the intent of Executive Order 13101, "Greening the Government through Waste Prevention, Recycling, and Federal Acquisition", products certified by SCS as meeting SCS-EPP-SP01-01 shall be given preferential consideration over registered products. Products that are registered shall be given preferential consideration over products not carrying any EPP designation.

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SD-02 Shop Drawings

Piping identification

Submit color stencil codes

SD-03 Product Data

Coating; ~~C A/E~~

Manufacturer's Technical Data Sheets

SD-04 Samples

Color; G REA/E

Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated.

SD-07 Certificates

Applicator's qualifications

Qualification Testing

SD-08 Manufacturer's Instructions

Application instructions

Mixing

Detailed mixing instructions, minimum and maximum application temperature and humidity, potlife, and curing and drying times between coats.

Manufacturer's Material Safety Data Sheets

Submit manufacturer's Material Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

SD-10 Operation and Maintenance Data

Coatings:

Preprinted cleaning and maintenance instructions for all coating systems shall be provided.

1.3 APPLICATOR'S QUALIFICATIONS

1.3.1 Contractor Qualification

Submit the name, address, telephone number, FAX number, and e-mail address of the contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on a minimum of three similar projects within the past three years. List information by individual and include the following:

- a. Name of individual and proposed position for this work.
- b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address, telephone number, and telex number (if non-US) of facility owner

Name of individual in facility owner's organization who can be contacted as a reference

Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

1.4 QUALITY ASSURANCE

1.4.1 Field Samples and Tests

The Contracting Officer may choose up to two coatings that have been delivered to the site to be tested at no cost to the Government. Take samples of each chosen product as specified in the paragraph "Sampling Procedures." Test each chosen product as specified in the paragraph "Testing Procedure." Products which do not conform, shall be removed from the job site and replaced with new products that conform to the referenced specification. Testing of replacement products that failed initial testing shall be at no cost to the Government.

1.4.1.1 Sampling Procedure

The Contracting Officer will select paint at random from the products that

have been delivered to the job site for sample testing. The Contractor shall provide one liter samples of the selected paint materials. The samples shall be taken in the presence of the Contracting Officer, and labeled, identifying each sample. Provide labels in accordance with the paragraph "Packaging, Labeling, and Storage" of this specification.

1.5 REGULATORY REQUIREMENTS

1.5.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

1.5.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.5.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.5.4 Asbestos Content

Materials shall not contain asbestos.

1.5.5 Mercury Content

Materials shall not contain mercury or mercury compounds.

1.5.6 Silica

Abrasive blast media shall not contain free crystalline silica.

1.5.7 Human Carcinogens

Materials shall not contain ACGIH Limit Values and ACGIH TLV-DOC confirmed human carcinogens (A1) or suspected human carcinogens (A2).

1.6 PACKAGING, LABELING, AND STORAGE

Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Pigmented paints shall be furnished in containers not larger than 20 liters. Paints and thinners shall be stored in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 4 to 35 degrees C.

1.7 SAFETY AND HEALTH

Apply coating materials using safety methods and equipment in accordance

with the following:

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in Section 01525, "Safety Requirements" and in Appendix A of EM 385-1-1. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.7.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC PA 3.

1.7.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

- a. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
- b. 29 CFR 1910.1000.
- c. ACGIH Limit Values, threshold limit values.

1.8 ENVIRONMENTAL CONDITIONS

1.8.1 Coatings

Do not apply coating when air or substrate conditions are:

- a. Less than 3 degrees C above dew point;
- b. Below 10 degrees C or over 35 degrees C, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

1.9 COLOR SELECTION

Colors of finish coats shall be as indicated or specified in the Finish Schedule. Where not indicated or specified, colors shall be selected by the Contracting Officer. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors approximate colors indicated and the product conforms to specified requirements.

Tint each coat progressively darker to enable confirmation of the number of coats.

1.10 LOCATION AND SURFACE TYPE TO BE PAINTED

1.10.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

- a. Surfaces behind portable objects and surface mounted articles

readily detachable by removal of fasteners, such as screws and bolts.

- b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.
- c. Existing coated surfaces that are damaged during performance of the work.

1.10.1.1 Interior Painting

Includes new surfaces of the building and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

- a. Exposed columns, girders, beams, joists, and metal deck.
- b. Other contiguous surfaces.

1.10.2 Painting Excluded

Do not paint the following unless indicated otherwise.

- a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.
- b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.
- c. Steel to be embedded in concrete.
- d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.
- e. Hardware, fittings, and other factory finished items.

1.10.3 Mechanical and Electrical Painting

Includes field coating of interior surfaces.

- a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.
 - (1) Exposed piping, conduit, and ductwork;
 - (2) Supports, hangers, air grilles, and registers;
 - (3) Miscellaneous metalwork and insulation coverings.
- b. Do not paint the following, unless indicated otherwise:
 - (1) New zinc-coated, aluminum, and copper surfaces under insulation
 - (2) New aluminum jacket on piping

(3) New interior ferrous piping under insulation.

1.10.3.1 Fire Extinguishing Sprinkler Systems

Clean, pretreat, prime, and paint new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories. Apply coatings to clean, dry surfaces, using clean brushes. Clean the surfaces to remove dust, dirt, rust, and loose mill scale. Immediately after cleaning, provide the metal surfaces with one coat primer per schedules. Shield sprinkler heads with protective covering while painting is in progress. Upon completion of painting, remove protective covering from sprinkler heads. Remove sprinkler heads which have been painted and replace with new sprinkler heads. Provide primed surfaces with the following:

*8

- a. Piping in Unfinished Areas: ~~Provide primed surfaces with one coat of red alkyd gloss enamel applied to a minimum dry film thickness of 0.025 mm in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.~~
- b. Piping in Finished Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel applied to a minimum dry film thickness of 0.025 mm.

1.10.4 Definitions and Abbreviations

1.10.4.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

1.10.4.2 Coating

A film or thin layer applied to a base material called a substrate. A coating may be a metal, alloy, paint, or solid/liquid suspensions on various substrates (metals, plastics, wood, paper, leather, cloth, etc.). They may be applied by electrolysis, vapor deposition, vacuum, or mechanical means such as brushing, spraying, calendering, and roller coating. A coating may be applied for aesthetic or protective purposes or both. The term "coating" as used herein includes emulsions, enamels, stains, varnishes, sealers, epoxies, and other coatings, whether used as primer, intermediate, or finish coat. The terms paint and coating are used interchangeably.

1.10.4.3 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

1.10.4.4 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five (5) levels are generically defined under the Assessment

sections in the MPI Maintenance Repainting Manual.

1.10.4.5 EPP

Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

1.10.4.6 EXT

MPI short term designation for an exterior coating system.

1.10.4.7 INT

MPI short term designation for an interior coating system.

1.10.4.8 micron / microns

The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

1.10.4.9 mil / mils

The English measurement for 0.001 in or one/one-thousandth of an inch, equal to 25.4 microns or 0.0254 mm.

1.10.4.10 mm

The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

1.10.4.11 MPI Gloss Levels

MPI system of defining gloss. Seven (7) gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte or Flat	0 to 5	10 max
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 min
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

Gloss is tested in accordance with ASTM D 523. Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

1.10.4.12 MPI System Number

The MPI coating system number in each Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN). The Division number follows the CSI Master Format.

1.10.4.13 Paint

See Coating definition.

1.10.4.14 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

1.10.4.15 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.2 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.3 PREPARATION OF METAL SURFACES

3.3.1 Ferrous Surfaces

- a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances:
Solvent clean or detergent wash in accordance with SSPC SP 1 to remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 2 or Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded

areas immediately upon detection.

3.3.2 Non-Ferrous Metallic Surfaces

Aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces.

- a. Surface Cleaning: Solvent clean in accordance with SSPC SP 1 and wash with mild non-alkaline detergent to remove dirt and water soluble contaminants.

3.4 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

3.4.1 Concrete and Masonry

- a. Curing: Concrete, stucco and masonry surfaces shall be allowed to cure at least 30 days before painting, except concrete slab on grade, which shall be allowed to cure 90 days before painting.

- b. Surface Cleaning: Remove the following deleterious substances.

(1) Dirt, Chalking, Grease, and Oil: Wash new surfaces with a solution composed of 0.2 liter trisodium phosphate, 0.1 liter household detergent, and 6.4 liters of warm water. Then rinse thoroughly with fresh water. For large areas, water blasting may be used.

(2) Paint and Loose Particles: Remove by wire brushing.

(3) Efflorescence: Remove by scraping or wire brushing followed by washing with a 5 to 10 percent by weight aqueous solution of hydrochloric (muriatic) acid. Do not allow acid to remain on the surface for more than five minutes before rinsing with fresh water. Do not acid clean more than 0.4 square meter of surface, per workman, at one time.

- c. Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.

- d. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not to surfaces with droplets of water. Do not apply epoxies to damp vertical surfaces as determined by ASTM D 4263 or horizontal surfaces that exceed 3 lbs of moisture per 1000 square feet in 24 hours as determined by ASTM F 1869. In all cases follow manufacturers recommendations. Allow surfaces to cure a minimum of 30 days before painting.

3.4.2 Gypsum Board

- a. Surface Cleaning: Gypsum board shall be dry. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be used if paint will be water-based.
- b. Repair of Minor Defects: Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects

with patching plaster or spackling compound and sand smooth.

3.5 PREPARATION OF WOOD AND PLYWOOD SURFACES

3.5.1 Plywood and Wood Surfaces, Except Floors:

- a. Wood surfaces shall be cleaned of foreign matter.

Surface Cleaning: Surfaces shall be free from dust and other deleterious substances and in a condition approved by the Contracting Officer prior to receiving paint or other finish. Do not use water to clean uncoated wood.

- b. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter in accordance with ASTM D 4444, Method A, unless otherwise authorized.
- c. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints.
- d. Cracks and Nailheads: Set and putty stop nailheads and putty cracks after the prime coat has dried.
- e. Cosmetic Repair of Minor Defects:

(1) Knots and Resinous Wood : Prior to application of coating, cover knots and stains with two or more coats of 1.3-kg-cut shellac varnish, plasticized with 0.14 liters of castor oil per liter.

(2) Open Joints and Other Openings: Fill with whiting putty, linseed oil putty. Sand smooth after putty has dried.

(3) Checking: Where checking of the wood is present, sand the surface, wipe and apply a coat of pigmented orange shellac. Allow to dry before paint is applied.

3.5.2 Interior Wood Surfaces, Stain Finish

Interior wood surfaces to receive stain shall be sanded. Oak and other open-grain wood to receive stain shall be given a coat of wood filler not less than 8 hours before the application of stain; excess filler shall be removed and the surface sanded smooth.

3.6 APPLICATION

3.6.1 Coating Application

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.

At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application.

Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Rollers for applying paints and

enamels shall be of a type designed for the coating to be applied and the surface to be coated.

Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

Thoroughly work coating materials into joints, crevices, and open spaces. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.

Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

Apply paint to new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metal work, and accessories. Shield sprinkler heads with protective coverings while painting is in progress. Remove sprinkler heads which have been painted and replace with new sprinkler heads. For piping in unfinished spaces, provide primed surfaces with one coat of red alkyd gloss enamel to a minimum dry film thickness of 0.025 mm. Unfinished spaces include attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and space where walls or ceiling are not painted or not constructed of a prefinished material. For piping in finished areas, provide prime surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel. Upon completion of painting, remove protective covering from sprinkler heads.

- a. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.
- b. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover surface of preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.
- c. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.

3.6.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written

permission shall include quantities and types of thinners to use.

When thinning is allowed, paints shall be thinned immediately prior to application with not more than 0.125 L of suitable thinner per liter. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.6.3 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.6.4 Coating Systems

- a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table

Division 3. Interior Concrete Paint Table
Division 4. Interior Concrete Masonry Units Paint Table
Division 5. Interior Metal, Ferrous and Non-Ferrous Paint Table
Division 6. Interior Wood Paint Table
Division 9: Interior Gypsum Board Paint Table

- b. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 0.038 mm each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.
- c. Coatings for Surfaces Not Specified Otherwise: Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.

3.7 COATING SYSTEMS FOR METAL

Apply coatings of Tables in Division 5 for Interior.

- a. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.
- b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.
- c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.
- d. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

- e. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

3.8 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings of Tables in Division 3, 4 and 9 for Interior.

3.9 COATING SYSTEMS FOR WOOD AND PLYWOOD

- a. Apply coatings of Tables in Division 6 for Interior.
- b. Prior to erection, apply two coats of specified primer to treat and prime wood and plywood surfaces which will be inaccessible after erection.
- c. Apply stains in accordance with manufacturer's printed instructions.

3.10 PIPING IDENTIFICATION

Piping Identification, Including Surfaces In Concealed Spaces: Provide in accordance with MIL-STD-101 or ANSI A13.1. Place stenciling in clearly visible locations. On piping not covered by MIL-STD-101 or ANSI A13.1, stencil approved names or code letters, in letters a minimum of 13 mm high for piping and a minimum of 50 mm high elsewhere. Stencil arrow-shaped markings on piping to indicate direction of flow using black stencil paint.

3.11 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

3.12 PAINT TABLES

All DFT's are minimum values.

3.12.1 INTERIOR PAINT TABLES

DIVISION 3: INTERIOR CONCRETE PAINT TABLE

A. Concrete ceiling in Firing Range:

1. Alkyd

MPI INT 3.1D-G3 (Eggshell)

Primer:	Intermediate:	Topcoat:
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MPI 50	MPI 51	MPI 51
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System DFT: 112 microns

DIVISION 4: INTERIOR CONCRETE MASONRY UNITS PAINT TABLE

A. Concrete masonry units in toilets, restrooms, shower areas, areas requiring a high degree of sanitation, and other high humidity areas, unless otherwise specified:

DIVISION 4: INTERIOR CONCRETE MASONRY UNITS PAINT TABLE

1. Alkyd

MPI INT 4.2N-G5 (Semigloss)

Filler: Primer: Intermediate: Topcoat:

MPI 4 MPI 50 MPI 47 MPI 47

System DFT: 300 microns

Fill all holes in masonry surface.

DIVISION 5: INTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

INTERIOR STEEL / FERROUS SURFACES

A. Metal, Mechanical, Electrical, Fire extinguishing sprinkler systems including valves, conduit, hangers, supports, Surfaces adjacent to painted surfaces (Match surrounding finish), exposed copper piping, and miscellaneous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment:

1. Alkyd

MPI INT 5.1E-G5 (Semigloss)

Primer: Intermediate: Topcoat:

MPI 79 MPI 47 MPI 47

System DFT: 300 microns

B. Metal floors (non-shop-primed surfaces or non-slip deck surfaces) with non-skid additive (NSA), load at manufacturer's recommendations:

1. Alkyd Floor Paint

MPI INT 5.1U-G6 (Gloss)

Primer: Intermediate: Topcoat:

MPI 79 MPI 27 MPI 27 (+NSA)

System DFT: 300 microns

C. Metal doors and frames:

1. Alkyd

MPI INT 5.1E-G5 (Semigloss)

Primer: Intermediate: Topcoat:

MPI 79 MPI 47 MPI 47

System DFT: 300 microns

D. Miscellaneous non-ferrous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment. Match surrounding finish:

1. Alkyd

MPI INT 5.4J-G5 (Semigloss)

Primer: Intermediate: Topcoat:

MPI 95 MPI 47 MPI 47

System DFT: 300 microns

E. Hot metal surfaces including smokestacks subject to temperatures up to 205 degrees C:

1. Heat Resistant Enamel

MPI INT 5.2A

Primer: Intermediate: Topcoat:

MPI 21 Surface preparation and number of coats per

INTERIOR STEEL / FERROUS SURFACES
manufacturer's instructions.
System DFT: Per Manufacturer

DIVISION 6: INTERIOR WOOD PAINT TABLE

A. Wood and plywood not otherwise specified:

1. Alkyd
MPI INT 6.4B-G5 (Semigloss)
Primer: Intermediate: Topcoat:
MPI 45 MPI 47 MPI 47
System DFT: 112 microns

B. Wood and Plywood, except floors; natural finish or stained:

1. Stained, oil-modified polyurethane
MPI INT 6.4E-G4
Stain: Primer: Intermediate: Topcoat:
MPI 90 MPI 57 MPI 57 MPI 57
System DFT: 100 microns

DIVISION 9: INTERIOR GYPSUM BOARD PAINT TABLE

A. Gypsum Wallboard not otherwise specified:

1. High Performance Architectural Latex - High Traffic Areas
MPI INT 9.2B-G3 (Eggshell)
Primer: Intermediate: Topcoat:
MPI 50 MPI 139 MPI 139
System DFT: 100 microns

MPI INT 9.2B-G5 (Semigloss)
Primer: Intermediate: Topcoat:
MPI 50 MPI 141 MPI 141
System DFT: 100 microns

B. Gypsum Wallboard in laboratories, toilets, restrooms, shower areas, areas requiring a high degree of sanitation, and other high humidity areas not otherwise specified:

1. Alkyd
MPI INT 9.2C-G5 (Semigloss)
Primer: Intermediate: Topcoat:
MPI 50 MPI 47 MPI 47
System DFT: 100 microns

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 09 - FINISHES

SECTION 09915

COLOR SCHEDULE

06/93

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- 1.2 SUBMITTALS

PART 2 PRODUCTS

- 2.1 REFERENCE TO MANUFACTURER'S COLOR
- 2.2 COLOR SCHEDULE
 - 2.2.1 Exterior Walls
 - 2.2.2 Exterior Trim
 - 2.2.3 Exterior Roof
 - 2.2.4 Interior Finishes

PART 3 EXECUTION (Not Applicable)

-- End of Section Table of Contents --

SECTION 09915

COLOR SCHEDULE

06/93

PART 1 GENERAL

1.1 GENERAL

This section covers color of exterior materials and products that are exposed to view in the finished construction. The word "color" as used herein includes surface color and pattern. Requirements for quality and method of installation are covered in other appropriate sections of the specifications. Specific locations where the various materials are required are shown on the drawings. Items not designated for color in this section may be specified in other sections. When color is not designated for items, the Contractor shall propose a color for approval.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Samples

Color Schedule; G RE

5 sets of color boards, 120 days after the Contractor is given Notice to proceed, complying with the following requirements:

- a. Color boards shall reflect all actual finish textures, patterns, and colors required for this contract.
- b. Materials shall be labeled with the finish type, manufacturer's name, pattern, and color reference.
- c. Samples shall be on size A4 or 8-1/2 by 11 inch boards with a maximum spread of size A1 or 25-1/2 by 33 inches for foldouts.
- d. Samples for this color board are required in addition to samples requested in other specification sections.
- e. Color boards shall be submitted to the following addresses:

Corp of Engineers
Criminal Investigation Laboratory

Architect's office

PART 2 PRODUCTS

2.1 REFERENCE TO MANUFACTURER'S COLOR

Where color is shown as being specific to one manufacturer, an equivalent color by another manufacturer may be submitted for approval. Manufacturers and materials specified are not intended to limit the selection of equal colors from other manufacturers.

2.2 COLOR SCHEDULE

The color schedule lists the colors, patterns and textures required for exterior and interior finishes, including both factory applied and field applied colors. Finishes for materials are defined in other sections of the specification.

2.2.1 Exterior Walls

Exterior wall colors shall apply to exterior wall surfaces including recesses at entrances and projecting vestibules. Conduit shall be painted to closely match the adjacent surface color. Wall color shall be provided to match the colors listed below.

- a. Brick: Brick Red to match base standard.
- b. Mortar: See SECTION 04200 "Masonry."
- c. Paint: To match approved curtain wall "BONE WHITE."
- d. Concrete Masonry Units (Integrally Colored): Natural
- f. Exterior Finish System: White to match curtain wall color.
- h. Glass and Glazing: Reference SECTION 08810.

2.2.2 Exterior Trim

Exterior trim shall be provided to match the colors listed below.

- a. Steel Doors and Door Frames: Red to match Brick.
- b. Curtain Wall (mullion, muntin, sash, trim, and sill): White to match "BONE WHITE" curtain wall.
- c. Wood Stain: N/A.
- d. Fascia: White to match curtain wall; other areas "approved" green to match standing seam roof .
- e. Downspouts, Gutter, Louvers, and Flashings: To match curtain wall system "WHITE."

- f. Handrails: Painted red to match brick.
- g. Soffits and Ceilings: White to match curtain wall.
- h. Signage: See Section 10430 Exterior Signage for color.
- i. Overhangs: To match curtain wall "BONE WHITE."
- j. Sealants: To match adjacent material.

2.2.3 Exterior Roof

Roof color shall apply to exterior roof surfaces including sheet metal flashings and copings, mechanical units, roof trim, pipes, conduits, electrical appurtenances, and similar items. Roof color shall be provided to match the colors listed below.

- a. Metal: Base "GREEN" as approved.

2.2.4 Interior Finishes

See Finish Schedule on the drawings.

PART 3 EXECUTION (Not Applicable)

-- End of Section --

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SECTION 09960

HIGH-PERFORMANCE COATINGS

07/92

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. All the latest versions of the referenced publications shall be used.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH Limit Values

Threshold Limit Values for Chemical
Substances and Physical Agents and
Biological Exposure Indices

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 117

Standard Practice for Operating Salt Spray
(Fog) Apparatus

ASTM D 1014

Standard Practice for Conducting Exterior
Exposure Tests of Paints on Steel

ASTM D 3273

Resistance to Growth of Mold on the
Surface of Interior Coating in an
Environmental Chamber

ASTM D 3274

Evaluating Degree of Surface Disfigurement
of Paint Films by Microbial (Fungal or
Algal) Growth or Soil and Dirt Accumulation

ASTM D 3359

Standard Test Methods for Measuring
Adhesion by Tape Test

ASTM D 4060

Standard Test Method for Abrasion
Resistance of Organic Coatings by the
Taber Abraser

ASTM D 4213

Standard Test Method for Scrub Resistance
of Paints by Abrasion Weight Loss

ASTM D 4214

Evaluating Degree of Chalking of Exterior
Paint Films

ASTM D 4258

Surface Cleaning Concrete for Coating

ASTM D 4263

Indicating Moisture in Concrete by Plastic
Sheet Method

ASTM D 4541

Standard Test Method for Pull-Off Strength
of Coatings Using Portable Adhesion Testers

ASTM D 4585 Standard Practice for Testing Water
Resistance of Coatings Using Controlled
Condensation

ASTM D 4587 Standard Practice for Fluorescent
UV-Condensation Exposures of Paint and
Related Coatings

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1500 (Rev A; Notice 1) Sealer, Surface (Latex
Block Filler)

CID A-A-1632 (Basic) Varnish, Asphalt

CID A-A-1788 (Canc. Notice 1)) Varnish, Oil; Interior

CID A-A-2246 (Rev B) Paint, Latex

CID A-A-2247 (Basic) Paint, Latex (Semigloss, Interior)

CID A-A-2248 (Basic) Paint, Latex, (Flat, Interior)

CID A-A-2339 (Canc. Notice 1) Stain (Wood, Solvent-Dye
Type)

CID A-A-2542 Sealer, Terrazzo and Concrete Floors,
Waterbased

CID A-A-2994 Primer Coating, Interior, for Walls and
Wood

FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1 (Rev J) Obstruction Marking and Lighting

FEDERAL SPECIFICATIONS (FS)

FS TT-C-542 (Rev E) Coating, Polyurethane, Oil-Free,
Moisture Curing

FS TT-C-555 (Rev B; Am 1) Coating, Textured (for
Interior and Exterior Masonry Surfaces)

FS TT-C-555B (Rev B; Am 1) Coating, Textured (for
Interior and Exterior Masonry Surfaces)

FS TT-E-2784 (Rev A) Enamel (Acrylic-Emulsion, Exterior
Gloss and Semigloss) (Metric)

FS TT-P-28 (Rev G; Notice 1) Paint, Aluminum, Heat
Resisting (1200 Degrees F.)

FS TT-S-708 (Rev A; Am 2; Notice 1) Stain, Oil;
Semi-Transparent, Wood, Exterior

FS TT-S-001992 (Basic; Notice 1) Stain, Latex, Exterior
for Wood Surfaces

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 18	Chlorinated Rubber Intermediate Coat Paint
SSPC Paint 20	Zinc-Rich Primers (Type I - "Inorganic" and Type II - "Organic")
SSPC Paint 23	Latex Primer for Steel surfaces
SSPC Paint 25	Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)
SSPC SP 1	Solvent Cleaning
SSPC SP 2	Hand Tool Cleaning
SSPC SP 3	Power Tool Cleaning
SSPC SP 6/NACE 3	Commercial Blast Cleaning
SSPC SP 7/NACE 4	Brush-Off Blast Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

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SD-03 Product Data

High Performance Coatings:~~G-A/E~~

The names, quantity represented, and intended use for the proprietary brands of materials proposed to be substituted for the specified materials when the required quantity of a particular batch is 200 L or less.

Mixing and Thinning
Application

Manufacturer's current printed product description, material safety data sheets (MSDS) and technical data sheets for each coating system. Detailed mixing, thinning and application instructions, minimum and maximum application temperature, and curing and drying times between coats for epoxy, moisture-curing polyurethane, and liquid glaze coatings. Detailed application instructions for textured coatings shall be provided.

SD-04 Samples

High Performance Coatings:~~G-A/E~~

While the material is at the site or source of supply, and at a time agreeable to the Contractor and the Contracting Officer, a 1 liter sample of each color and batch, except for quantities of 200

liters or less, shall be taken by random selection from the sealed containers by the Contractor in the presence of a representative of the Contracting Officer. The contents of the containers to be sampled shall be thoroughly mixed to ensure that the sample is representative. Samples shall be identified by designated name, specification number, manufacturer name and address, batch number, project contract number, intended use, and quantity involved.

SD-06 Test Reports

High Performance Coatings

A statement as to the quantity represented and the intended use, plus the following test report for batches in excess of 200 L.

a. A test report showing that the proposed batch to be used meets specified requirements:

b. A test report showing that a previous batch of the same formulation as the batch to be used met specified requirements, plus, on the proposed batch to be used, a report of test results for properties of weight per liter, viscosity, fineness of grind, drying time, color, and gloss.

SD-07 Certificates

Lead

Mildewcide and Insecticide

Volatile Organic Compound (VOC) Content

Certificate stating that paints for interior use contain no mercurial mildewcide or insecticide. Certificate stating that paints proposed for use contain not more than 0.06 percent lead by weight of the total nonvolatile. Certificate stating that paints proposed for use meet Federal VOC regulations and those of the of the local Air Pollution Control Districts having jurisdiction over the geographical area in which the project is located.

1.3 PACKAGING, LABELING, AND STORING

High performance coatings shall be in sealed containers that legibly show the designated name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Pigmented paints shall be furnished in containers not larger than 20 liters. Paints and thinner shall be stored in accordance with the manufacturer's written directions and as a minimum stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors and at temperatures between 4 and 35 degrees C. Paints shall be stored on the project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for testing.

1.4 APPROVAL OF MATERIALS

When samples are tested, approval of materials will be based on tests of the samples; otherwise, materials will be approved based on test reports furnished with them. If materials are approved based on test reports furnished, samples will be retained by the Government for testing should the materials appear defective during or after application. In addition to

any other remedies under the contract the cost of retesting defective materials will be at the Contractor's expense.

1.5 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the paint manufacturer, the ambient temperature shall be between 7 and 35 degrees C when applying coatings other than water-thinned, epoxy. Water-thinned coatings shall be applied only when ambient temperature is between 10 and 32 degrees C. Epoxy coatings shall be applied only within the minimum and maximum temperatures recommended by the coating manufacturer.

1.6 SAFETY AND HEALTH

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in the CONTRACT CLAUSES. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.6.1 Worker Exposures

Exposure of workers to hazardous chemical substances shall not exceed limits established by ACGIH Limit Values, or as required by a more stringent applicable regulation.

1.6.2 Toxic Compounds

Toxic products having ineffective physiological warning properties, such as no or low odor or irritation levels, shall not be used unless approved by the Contracting Officer.

1.6.3 Training

Workers having access to an affected work area shall be informed of the contents of the applicable material data safety sheets (MDSS) and shall be informed of potential health and safety hazard and protective controls associated with materials used on the project. An affected work area is one which may receive mists and odors from the painting operations. Workers involved in preparation, painting and clean-up shall be trained in the safe handling and application, and the exposure limit, for each material which the worker will use in the project. Personnel having a need to use respirators and masks shall be instructed in the use and maintenance of such equipment.

1.6.4 Coordination

Work shall be coordinated to minimize exposure of building occupants, other Contractor personnel, and visitors to mists and odors from preparation, painting and clean-up operations.

PART 2 PRODUCTS

2.1 HIGH PERFORMANCE COATINGS

2.1.1 Colors and Tints

Colors shall be as selected from manufacturer's standard colors, as

indicated. Manufacturer's standard color is for identification of color only. Tinting of epoxy paints shall be done by the manufacturer. The color of the undercoats shall vary slightly from the color of the next coat.

2.1.1.2 Volatile Organic Compound (VOC) Content

Paints shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards and shall conform to the restrictions of the local air pollution control authority, and the limitations set forth in this specification, whichever is lower.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS NOT TO BE PAINTED

Items not to be painted which are in contact with or adjacent to painted surfaces shall be removed or protected prior to surface preparation and painting operations. Items removed prior to painting shall be replaced when painting is completed. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

3.2 SURFACE PREPARATION

Surfaces to be painted shall be clean and free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.2.1 Ferrous Surfaces

Ferrous surfaces including those that have been shop-coated, shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be cleaned mechanically with hand tools according to SSPC SP 2, power tools according to SSPC SP 3 or by sandblasting according to SSPC SP 7/NACE 4. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

3.2.2 Nonferrous Metallic Surfaces

Galvanized, aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1.

3.2.3 Concrete Masonry Surfaces

Allow masonry surfaces and mortar to cure at least 30 days before painting. Remove efflorescence and loose mortar by scraping or wire brushing followed by washing with a 5 to 10 percent by weight aqueous solution of hydrochloric acid. Do not allow the acid to remain on the surface for more than five minutes before rinsing with fresh water. Repair or fill mortar joints in minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application. Do not apply epoxies to damp vertical surfaces as determined by ASTM D 4263.

3.2.4 High Impact Gypsum Board Surfaces

High impact gypsum board surfaces shall be dry and shall have all loose dirt and dust removed by brushing with a soft brush, rubbing with a cloth, or vacuum-cleaning prior to application of the first-coat material. A damp cloth or sponge may be used if paint will be water-based.

3.2.5 Exposed Exterior Structural Steel

All exposed exterior steel shall be a color as approved to match the curtain wall color. It shall be shop-primed. The level of paint shall be capable of resisting marine conditions, and as specified.

3.3 MIXING AND THINNING

When thinning is approved as necessary to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions. When thinning is allowed, paints shall be thinned immediately prior to application with not more than 0.125 L of suitable thinner per liter. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.3.1 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.4 APPLICATION

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application. Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

3.4.1 Ventilation

Affected areas shall be ventilated during paint application so that workers exposure to chemical substances shall not exceed limits as established by ACGIH Limit Values, or as required by a more stringent applicable regulation. Interior work zones having a volume of 280 cubic meters or less shall be ventilated at a minimum of 2 air exchanges per hour. Ventilation in larger work zones shall be maintained by means of mechanical

exhaust. Solvent vapors shall be exhausted outdoors, away from air intakes and workers. Return air inlets in the work zone shall be temporarily sealed before start of work until the coatings have dried.

3.4.2 Respirators

Operators and personnel in the vicinity of operating paint sprayers shall wear respirators.

3.4.3 First Coat

The first coat on gypsum wallboard, and other surfaces shall include repeated touching up of suction spots or overall application of primer or sealer to produce uniform color and gloss. Excess sealer shall be wiped off after each application.

3.4.4 Timing

Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practical after such pretreatment has been completed, but prior to any deterioration of the prepared surface. Sufficient time shall elapse between successive coats to permit proper drying. This period shall be modified as necessary to suit weather conditions. Oil-based or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause the undercoat to lift or lose adhesion. Manufacturer's instructions for application, curing and drying time between coats of two-component systems shall be followed.

3.4.5 Ferrous-Metal Primer

Primer for ferrous-metal shall be applied to ferrous surfaces to receive paint other than asphalt varnish prior to deterioration of the prepared surface. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

3.5 PAINTING SCHEDULE

3.5.1 General

Field apply bottom coats scheduled except where the contract documents require shop coating of ferrous metals. Where first coat shows signs of suction spots or poorly sealed areas, reapply first coat material to adequately seal surface before preceding with successive coats. Ferrous metals that have not been shop primed shall be field primed promptly after arrival at the site, or shall be stored away from the effects of weather. Reprepare and retouch damaged prime coats using approved, compatible primer.

3.5.2 Exterior

3.5.2.1 Exterior Structural Steel and other Ferrous Metals

Moderate Environment (semigloss finish): One finish coat over an intermediate coat and a primer.

- a. Primer: As defined in Section 05120 for shop-primed steel, or if

field painted, meeting the following criteria:

1. Polyamidoamine Epoxy, lead-and chromate-free, corrosion inhibiting pigment.
2. Volume Solids: not less than 70 percent.
3. Volatile Organic Compounds (VOC): not more than 2.90 pounds per gallon (thinned 10 percent).
4. Dry Film Thickness: 2.0 to 4.0 mils.
5. Color: Beige.
6. QUV Exposure: no less than 97 percent gloss retention after 2,000 hours exposure (ASTM D 4587, UVA-340 bulbs, 4 hours light, 4 hours dark).
7. Adhesion: no less than a rating of 5 ASTM D 3359, Method B.
8. Exterior Exposure: no blistering, cracking, rusting or delamination of film. No rust creepage at scribe and no rusting at edges after 35,000 hours exterior exposure (one coat on prepared steel).
9. Salt Spray (Fog): no blistering, cracking, rusting or delamination of film. No rust creepage after 500 hours exposure (ASTM B 117).

b. Intermediate Coat shall conform to the following:

1. Polyamide Epoxy.
2. Volume Solids: not less than 55 percent.
3. Volatile Organic Compounds (VOC): not more than 3.40 pounds per gallon (thinned 10 percent).
4. Dry Film Thickness: 2.0 to 4.0 mils.
5. Color: different than primer and slightly different than finish but easily identifiable.
6. Adhesion: no less than 1,000 psi pull ASTM D 4541.
7. Exterior Exposure: no blistering, cracking, rusting or delamination of film. No rust creepage at scribe and no rusting at edges after 50,000 hours exterior exposure (two coats on prepared steel).
8. Humidity: no blistering, cracking, rusting or delamination of film after 4,500 hours exposure (ASTM D 4585).
9. Salt Spray (Fog): no blistering, cracking, rusting or delamination of film. No more than 0.8 mm rust creepage at scribe after 1,500 hours exposure (ASTM B 117).

c. Topcoat shall conform to the following:

1. Aliphatic Acrylic Polyurethane.
2. Volume Solids: not less than 70 percent.
3. Volatile Organic Compounds (VOC): not more than 2.90 pounds per gallon (thinned 10 percent).
4. Dry Film Thickness: 2.0 to 4.0 mils.
5. Color: As indicated in the Finish Schedule.
6. Adhesion: no less than 1,000 psi pull over epoxy primer (ASTM D 4541).
7. Exterior Exposure: no less than 92 percent gloss retention after 500 MJ/m² UV exposure (ASTM D 1014, EMMAQUA).
8. Humidity: no blistering, cracking, rusting or delamination of film after 1,500 hours exposure (ASTM D 4585).
9. Salt Spray (Fog): no blistering, cracking, rusting or delamination of film. No rust creepage at scribe after 1,500 hours exposure (ASTM B 117).
10. QUV Exposure: no less than 97 percent gloss retention after

2,000 hours exposure (ASTM D 4587, UVA-340 bulbs, 4 hours light, 4 hours dark).

3.5.2.2 Nonferrous Metal

Moderate Environment (high-gloss finish): One finish coat over an intermediate coat and a primer.

- a. Primer: Epoxy primer applied at spreading rate recommended by manufacturer shall conform to the following:
 1. Polyamide Epoxy.
 2. Volume Solids: not less than 55 percent.
 3. Volatile Organic Compounds (VOC) not more than 3.40 pounds per gallon (thinned 10 percent).
 4. Dry Film Thickness: 2.0 to 4.0 mils.
 5. Adhesion: no less than 1,000 psi pull (ASTM D 4541).
 6. Exterior Exposure: no blistering, cracking, rusting or delamination of film. No rust creepage at scribe and no rusting at edges after 50,000 hours exterior exposure (two coats on prepared steel).
 7. Humidity: no blistering, cracking, rusting or delamination of film after 4,500 hours exposure (ASTM D 4585).
 8. Salt Spray (Fog): no blistering, cracking, rusting or delamination of film. No more than 0.8 mm rust creepage at scribe after 1,500 hours exposure (ASTM B 117).
- b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer shall conform to the following:
 1. Polyamide Epoxy.
 2. Volume Solids: not less than 55 percent.
 3. Volatile Organic Compounds (VOC): not more than 3.40 pounds per gallon (thinned 10 percent).
 4. Dry Film Thickness: 2.0 to 4.0 mils.
 5. Color: different than primer and slightly different than finish but easily identifiable.
 6. Adhesion: no less than 1,000 psi pull ASTM D 4541.
 7. Exterior Exposure: no blistering, cracking, rusting or delamination of film. No rust creepage at scribe and no rusting at edges after 50,000 hours exterior exposure (two coats on prepared steel).
 8. Humidity: no blistering, cracking, rusting or delamination of film after 4,500 hours exposure (ASTM D 4585).
 9. Salt Spray (Fog): no blistering, cracking, rusting or delamination of film. No more than 0.8 mm rust creepage at scribe after 1,500 hours exposure (ASTM B 117).
- c. Topcoat shall conform to the following:
 1. Aliphatic Acrylic Polyurethane.
 2. Volume Solids: not less than 70 percent.
 3. Volatile Organic Compounds (VOC): not more than 2.90 pounds per gallon (thinned 10 percent).
 4. Dry Film Thickness: 2.0 to 4.0 mils.
 5. Color: As indicated in the Finish Schedule.
 6. Adhesion: no less than 1,000 psi pull over epoxy primer (ASTM D 4541).
 7. Exterior Exposure: no less than 92 percent gloss retention

after 500 MJ/m² UV exposure (ASTM D 1014, EMMAQUA).

8. Humidity: no blistering, cracking, rusting or delamination of film after 1,500 hours exposure (ASTM D 4585).

9. Salt Spray (Fog): no blistering, cracking, rusting or delamination of film. No rust creepage at scribe after 1,500 hours exposure (ASTM B 117).

10. QUV Exposure: no less than 97 percent gloss retention after 2,000 hours exposure (ASTM D 4587, UVA-340 bulbs, 4 hours light, 4 hours dark).

3.5.3 Interior

3.5.3.1 High Impact Gypsum Wallboard

Moderate Environment (semi-gloss finish): One finish coat over an intermediate coat and a primer.

a. Primer shall conform to the following criteria:

1. Vinyl Acrylic.
2. Volume Solids: not less than 28 percent.
3. Volatile Organic Compounds (VOC): not more than 1.30 pounds per gallon.
4. Dry Film Thickness: 1.0 to 2.0 mils.
5. Color: White.

b. Intermediate Coat shall conform to the following criteria:

1. Crosslinking Waterborne Acrylic Epoxy.
2. Volume Solids: not less than 42 percent.
3. Volatile Organic Compounds (VOC): not more than 2.60 pounds per gallon (thinned 10 percent).
4. Dry Film Thickness: 4.0 to 6.0 mils.
5. Color: different than primer and slightly different than finish but easily identifiable.
6. Abrasion: no more than 160 mg loss after 1,000 cycles (ASTM D 4060, CS-17 wheel, 1,000 grams load).
7. Adhesion: no less than 380 psi pull over concrete block (ASTM D 4541).
8. Chemical Resistance: no evidence of blistering, loss of adhesion or softening after four hours exposure to the following chemicals:

Sodium Hydroxide, 5 percent
Sodium Phosphate, 5 percent
Hydrochloric Acid, 5 percent
Sulfuric Acid, 5 percent
Sodium Hypochlorite, 5 percent

9. Humidity: no blistering, cracking, rusting or delamination of film after 1,000 hours exposure (ASTM D 4585).

10. Scrubbability: no more than 0.8 mils removed and less than 2 units gloss change after 1,000 cycles. Erosion rate of dry film less than 25 microlitres per 1,000 cycles (ASTM D 4213).

11. Stain Resistance: no staining when exposed to the following substances for 16 hours by spot testing:

Blood, catsup, Crisco oil, lime juice, margarine, salad dressing, sodium hydroxide.

c. Topcoat shall conform to the following criteria:

1. Crosslinking Waterborne Acrylic Epoxy.
2. Volume Solids: not less than 42 percent.
3. Volatile Organic Compounds (VOC): not more than 2.60 pounds per gallon (thinned 10 percent).
4. Dry Film Thickness: 4.0 to 6.0 mils.
5. Color: As indicated in the Finish Schedule.
6. Abrasion: no more than 160 mg loss after 1,000 cycles (ASTM D 4060, CS-17 wheel, 1,000 grams load).
7. Adhesion: no less than 380 psi pull over concrete block (ASTM D 4541).
8. Chemical Resistance: no evidence of blistering, loss of adhesion or softening after four hours exposure to the following chemicals:

Sodium Hydroxide, 5 percent
Sodium Phosphate, 5 percent
Hydrochloric Acid, 5 percent
Sulfuric Acid, 5 percent
Sodium Hypochlorite, 5 percent

9. Humidity: no blistering, cracking, rusting or delamination of film after 1,000 hours exposure (ASTM D 4585).
10. Scrubbability: no more than 0.8 mils removed and less than 2 units gloss change after 1,000 cycles. Erosion rate of dry film less than 25 microlitres per 100 cycles (ASTM D 4213).
11. Stain Resistance: no staining when exposed to the following substances for 16 hours by spot testing:

Blood, catsup, Crisco oil, lime juice, margarine, salad dressing, sodium hydroxide.

3.5.3.2 Concrete Masonry Units

Moderate Environment (semi-gloss finish): One finish coat over an intermediate coat and a surfacer.

a. Surfacers shall conform to the following criteria:

1. Waterborne Cementitious Acrylic.
2. Volume Solids: not less than 65 percent.
3. Volatile Organic Compounds (VOC): not more than 0.70 pounds per gallon (thinned 5 percent).
4. Spread Rate: 60 to 80 square feet per gallon.
5. Color: Olive.
6. Humidity: no cracking, blistering or visible loss of film integrity after 1,500 hours exposure (ASTM D 4585).
7. Wind Driven Rain Resistance: no cracking, blistering or visible damage to the substrate or coating. No visible dampness on the backside of the test specimen after 24 hours exposure (TT-C-555B, 4.4.7.3 Wind-driven rain test).

b. Intermediate Coat shall conform to the following criteria:

1. Crosslinking Waterborne Acrylic Epoxy.
2. Volume Solids: not less than 42 percent.
3. Volatile Organic Compounds (VOC): not more than 2.60 pounds

per gallon (thinned 10 percent).

4. Dry Film Thickness: 4.0 to 6.0 mils.
5. Color: different than primer and slightly different than finish but easily identifiable.
6. Abrasion: no more than 160 mg loss after 1,000 cycles (ASTM D 4060, CS-17 wheel, 1,000 grams load).
7. Adhesion: no less than 380 psi pull over concrete block (ASTM D 4541).
8. Chemical Resistance: no evidence of blistering, loss of adhesion or softening after four hours exposure to the following chemicals:

Sodium Hydroxide, 5 percent
Sodium Phosphate, 5 percent
Hydrochloric Acid, 5 percent
Sulfuric Acid, 5 percent
Sodium Hypochlorite, 5 percent

9. Humidity: no blistering, cracking, rusting or delamination of film after 1,000 hours exposure (ASTM D 4585).
10. Scrubbability: no more than 0.8 mils removed and less than 2 units gloss change after 1,000 cycles. Erosion rate of dry film less than 25 microlitres per 100 cycles (ASTM D 4213).
11. Stain Resistance: no staining when exposed to the following substances for 16 hours by spot testing:

Blood, catsup, Crisco oil, lime juice, margarine, salad dressing, sodium hydroxide.

c. Topcoat shall conform to the following criteria:

1. Crosslinking Waterborne Acrylic Epoxy.
2. Volume Solids: not less than 42 percent.
3. Volatile Organic Compounds (VOC): not more than 2.60 pounds per gallon (thinned 10 percent).
4. Dry Film Thickness: 4.0 to 6.0 mils.
5. Color: As indicated in the Finish Schedule.
6. Abrasion: no more than 160 mg loss after 1,000 cycles (ASTM D 4060, CS-17 wheel, 1,000 grams load).
7. Adhesion: no less than 380 psi pull over concrete block (ASTM D 4541).
8. Chemical Resistance: no evidence of blistering, loss of adhesion or softening after four hours exposure to the following chemicals:

Sodium Hydroxide, 5 percent
Sodium Phosphate, 5 percent
Hydrochloric Acid, 5 percent
Sulfuric Acid, 5 percent
Sodium Hypochlorite, 5 percent

9. Humidity: no blistering, cracking, rusting or delamination of film after 1,000 hours exposure (ASTM D 4585).
10. Scrubbability: no more than 0.8 mils removed and less than 2 units gloss change after 1,000 cycles. Erosion rate of dry film less than 25 microlitres per 100 cycles (ASTM D 4213).
11. Stain Resistance: no staining when exposed to the following substances for 16 hours by spot testing:

Blood, catsup, Crisco oil, lime juice, margarine, salad dressing, sodium hydroxide.

3.5.3.3 Interior exposed steel, ferrous metal, and non-ferrous metal

Moderate Environment (semigloss finish): One finish coat over an intermediate coat and a primer.

- a. Primer: As defined in Section 05120 for shop-primed steel, or if field painted, meeting the following criteria:

1. Polyamidoamine Epoxy, lead-and chromate-free, corrosion inhibiting pigment.
2. Volume Solids: not less than 70 percent.
3. Volatile Organic Compounds (VOC): not more than 2.90 pounds per gallon (thinned 10 percent).
4. Dry Film Thickness: 2.0 to 4.0 mils.
5. Color: Beige.
6. QUV Exposure: no less than 97 percent gloss retention after 2,000 hours exposure (ASTM D 4587, UVA-340 bulbs, 4 hours light, 4 hours dark).
7. Adhesion: no less than a rating of 5 (ASTM D 3359, Method B).
8. Exterior Exposure: no blistering, cracking, rusting or delamination of film. No rust creepage at scribe and no rusting at edges after 35,000 hours exterior exposure (one coat on prepared steel).
9. Salt Spray (Fog): no blistering, cracking, rusting or delamination of film. No rust creepage after 500 hours exposure (ASTM B 117).

- b. Intermediate Coat shall conform to the following:

1. Polyamide Epoxy.
2. Volume Solids: not less than 55 percent.
3. Volatile Organic Compounds (VOC): not more than 3.40 pounds per gallon (thinned 10 percent).
4. Dry Film Thickness: 2.0 to 4.0 mils.
5. Color: different than primer and slightly different than finish but easily identifiable.
6. Adhesion: no less than 1,000 psi pull ASTM D 4541.
7. Exterior Exposure: no blistering, cracking, rusting or delamination of film. No rust creepage at scribe and no rusting at edges after 50,000 hours exterior exposure (two coats on prepared steel).
8. Humidity: no blistering, cracking, rusting or delamination of film after 4,500 hours exposure (ASTM D 4585).
9. Salt Spray (Fog): no blistering, cracking, rusting or delamination of film. No more than 0.8 mm rust creepage at scribe after 1,500 hours exposure (ASTM B 117).

- c. Topcoat shall conform to the following:

1. Aliphatic Acrylic Polyurethane.
2. Volume Solids: not less than 70 percent.
3. Volatile Organic Compounds (VOC): not more than 2.90 pounds per gallon (thinned 10 percent).
4. Dry Film Thickness: 2.0 to 4.0 mils.
5. Color: As indicated in the Finish Schedule.

6. Adhesion: no less than 1,000 psi pull over epoxy primer (ASTM D 4541).
7. Exterior Exposure: no less than 92 percent gloss retention after 500 MJ/m² UV exposure (ASTM D 1014, EMMAQUA).
8. Humidity: no blistering, cracking, rusting or delamination of film after 1,500 hours exposure (ASTM D 4585).
9. Salt Spray (Fog): no blistering, cracking, rusting or delamination of film. No rust creepage at scribe after 1,500 hours exposure (ASTM B 117).
10. QUV Exposure: no less than 97 percent gloss retention after 2,000 hours exposure (ASTM D 4587, UVA-340 bulbs, 4 hours light, 4 hours dark).

3.5.4 Cleaning and Protection

3.5.4.1 Cleaning

Clean work area on a daily basis; dispose of spent materials and empty containers. If requested, turn over to the Contracting Officer all empty coatings containers used during the course of each day. Remove all trace of coatings from adjacent surfaces not scheduled to be coated. Remove by appropriate methods that do not damage surfaces.

3.5.4.2 Protection

Protect work against damage until fully cured. Provide signs identifying wet surfaces until surfaces are adequately cured. Shortly before final completion of the project, examine surfaces for damage to coatings and restore coatings to new, undamaged condition. Touch-up of minor damage will be acceptable where result is not visibly different from surrounding surfaces. Where result is different either in color, sheen, or texture, recoat entire surface.

-- End of Section --